

# Aviation Week & Space Technology

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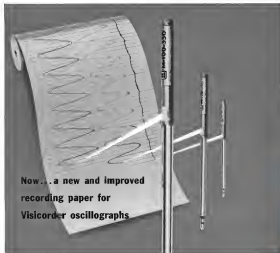
A McGraw-Hill Publication

July 23, 1962

**Lunar Orbital  
Rendezvous  
Mission Details**

**New Wide-Band Antenna**





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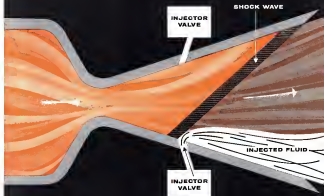


*First in Control*

**CAPABILITY is spelled**

**s-e-c-o-n-d-a-r-y i-n-j-e-c-t-i-o-n**

The Aerospace Division of Vickers Incorporated has successfully completed a secondary injection thrust vector control system R&D program for the United States Navy.



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Located on 10,000 acres near Sacramento, California, Aerojet-General's Solid Rocket Plant is the largest installation of its kind in the world. Manured by a staff of over 8,000, the Solid Rocket Plant includes 2,000,000 square feet of floor space, extensive research and development facilities, and equipment for fabricating steel, titanium, glass, and composites. Total capacity of Aerojet's batch and continuous mix equipment—over 45,000,000 pounds of solid propellant a year.

**SOLID ROCKET PLANT / Sacramento, California**

## AEROSPACE CALENDAR

(Continued from page 5)

- Aug. 13-14-*Advanced Symposium in Ballistic Missile and Space Technology*, U. S. Air Force Academy, Colorado Springs, Colo. **Sponsor:** USAF; Aerospace Corp.
- Aug. 14-15-*Congresso Equipamento Cientifico*, University of California at Los Angeles, Los Angeles, Calif.
- Aug. 14-17-*International Conference on Fusion Electronics and Microwaves*, Boulder Laboratories, National Bureau of Standards, Boulder, Colo.
- Aug. 15-17-*Nuclear Propulsion Conference*, Monterey, Calif. Joint Meeting Institute of the Aerospace Sciences, American Rocket Society, American Nuclear Society. **(Continued)**
- Aug. 17-19-*Third International Electronic Circuit Packaging Symposium*, University of Colorado, Boulder, Colo.
- Aug. 18-19-*Calypso*, Lockheed, Laboratory Flying Corps and Aerospace of The French Foreign Legion, Le Bourget Air Base, Paris, France.
- Aug. 19-21-*Naval Meeting and Conference*, Airport Operations Council, Prince Karlens Hotel, Stockholm, Sweden.
- Aug. 20-*Third Symposium*, Precision Technology Manufacturers Assn. Also for Hilton Hotel, Los Angeles, Calif.
- Aug. 21-24-*Western Electronics Show and Conference*, Institute of Radio Engineers, Los Angeles, Calif.
- Aug. 21-24-*International Symposium on Fire Related Symposium*, Mission City on Island, Connecticut, U.S. Space Materials Control Association, Systems Division, Air Force Systems Command.
- Aug. 21 Sept. 17-19-*Italian National Civil Aviation Organization Assembly*, Rome, Italy.
- Aug. 23-24-*Quarterly Regional Meeting*, Assn. of Local Transport Airlines, Westwood Hotel, Anchorage, Alaska.
- Aug. 23-24-*Conference on Thin Film*, Colorado Hotel, Glenwood Springs, Colo. **Sponsor:** Solid State Electronics Laboratory, University of Denver's Research Institute.
- Aug. 27-28-*AIIE Technical Conference on Advanced Electronic Materials*, Brookline Franklin Hotel, Philadelphia Pa.
- Aug. 27-29-*Third International Congress*, International Council of the Aerospace Sciences, New Congress Hall, Stockholm, Sweden.
- Aug. 27-29-*Third International Congress*, International Federation of Information Processing Societies, Munich.
- Aug. 28-30-*Fourth Conference on Miniaturization of Electronic Equipment*, Electronic Industries Assn. in cooperation with Department of Defense, University of Colorado, Boulder, Colo.
- Sept. 17-*National Advanced Technology Management Conference*, Institute of Aeronautics, Seattle, Wash.
- Sept. 17-*International Symposium on Isotopes in Theory*, Institute of Radio Engineers, Brussels, Belgium.
- Sept. 18-19-*1962 Flying Display and Exhibition*, Society of British Aircraft Constructors, Farnborough, England.
- Sept. 47-*National Advanced Technology Management Conference*, Open House, (Continued on page 9)

## Four important questions you should ask before selecting any scientific or engineering computer.

They lead to the one sure way to find the computer that suits you best.

A computer investment can be a wise one at an expensive one. Basically it depends on finding the computer that best serves your needs. The Recomp guide to solid state scientific and engineering computers has been found useful for many leading universities. Perhaps it could best find your needs. The following questions may offer some guidance in your choice.

### (1) What should you pay for a computer?

Scientific problem solving computers sell from \$40,000 and up. They lease from \$1,333 and up a month. That may seem important, but the total cost is how much a computer will give you over a period of time.

A feasibility study showed that a Recomp computer could save almost \$20,000 more than its nearest competitor in a year on a given project. In addition, Recomp offers an ideal lease price range. For medium-scale needs, Recomp starts at \$2,495, and with a complete line of peripheral equipment goes to \$4,500. Recomp is ideal for small scale needs. You can lease for \$1,695, complete.

### (2) What software is available?

Defining software is: portable compilers, interpretive routines, programming library and exchange, special applications, word graphs, etc.—will help you get the maximum use of your computer. Recomp's software and accessory line use the most useful in the computer industry. And its extensive programming library is available without charge.

### (3) Will you have to hire specialized computer personnel?

Some computers demand specialized programming personnel to operate them. Others are so simple that engineers can program their problems directly. This ease of programming saves time and increases computer use. One of the easiest computers to program and operate is Recomp. Engineers with less than eight hours instruction are able to use the computer productively.

### (4) What will a computer do for you?

You'll probably never know the complete answer to this until you have one in your own firm. Most companies find rewards of use in addition to the one they originally sought the computer for. But some computers are more useful than others. For example, a company that were to get 2 programs a year from a top creative scientist, was able to increase this figure to 37.5 with a computer (ask Recomp). But with Recomp this company is now able to get 400 programs each year.

### The one sure way to select a computer

The computer requirements of every company are unique. The best way to find the computer that fits your own particular requirements is through a computer feasibility study. This is the only way to know exactly what computer suits you and your company best.

One final tip: no computer feasibility study is complete without Recomp. Put Recomp's aids to side with any computer purchase on the market. Let the aids speak for themselves. Write today for this helpful guide: How To Conduct A Computer Feasibility Study.

## Recomp

Recomp is a product of Action-Net Industrial Products  
Action-Net is a Division of North American Aviation

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A Division of Lockheed Aircraft Corporation

## AEROSPACE CALENDAR

(Continued from page 7)

- Seattle World's Fair grounds. With Spaceman University of Washington, pre-launch engineering group and televisionally oriented business firms.
- Sept. 4-5—Symposium on Measurement of Thermal Radiation Properties of Solids, Ballhaus Hotel, Dayton, Ohio. Sponsors: Astronautical Systems Division (NASA), National Bureau of Standards, NASA.
- Sept. 20-24—Facts National Conference on Applied Meteorology, American Meteorological Society, Bingham, Va.
- Sept. 10-14—Aerospace General Meeting, International Air Transport Assn., Dublin.
- Sept. 13-14—10th Annual Engineering Management Conference (IRE), Hotel Kentucky, New Orleans, La.
- Sept. 27-28—Hydrofoil & Air-Cushion Vehicle Meeting, Institute of the Aerospace Sciences, Sheraton Hotel, Washington.
- Sept. 10-20—Delaware Environmental Research Symposium, El Tropico Hotel, San Antonio, Tex. Sponsors: Foreign Central Research Office of the Office of the Chief of Ordnance. Sponsored by Southwest Research Institute.
- Sept. 30-15—16th National Conference & Aerospace Fairness, Air Force Area, Las Vegas, Nev.
- Sept. 19-20—Technical Managers' Union Fall Meeting, Institute of the Aerospace Sciences, Hotel Commodore, New York.
- Sept. 19-20—Operations & Maintenance Symposium, Aerojet Corp., Mirfield, N.J.
- Sept. 19-21—South National Conference on Tube Technology, Western Union Auditorium, New York, N.Y. Sponsors: Adco Corp. on Chicago on Electric Drive.
- Sept. 19-22—Second International Agricultural Aviation Congress, National Super Agency School, Craggan, France.
- Sept. 24-26-19th International Symposium of Congress, American Rocket Society, Sofia, Bulgaria.
- Sept. 24-Oct. 12—International Air Transport Assn. Traffic Conference, San Marino Hotel, Chantilly, France.
- Sept. 21-26—Space Power Systems Conference, American Radio Society, Moscow (USSR), State Moscow, USSR.
- Sept. 26-Oct. 1-1962 General Conference, Federation Aeronautique Internationale, Vienna, Austria.
- Sept. 28-29—Review of Experimental Test Plans, Sixth Annual Airtech Report & Symposium, Brooklynton Hotel, New York City.
- Oct. 1-5—South Annual Exposition & Symposium, Air Traffic Control Assn., Peninsula Hotel, Las Vegas, Nev.
- Oct. 2-4—Third Symposium on Advanced Population Concepts, General Assn. of Cosmonauts, General Electric.
- Oct. 2-4—National Symposium on Space Electronics and Telecommunications, Institute of Radio Engineers, Postgraduate Hotel, Miami Beach, Fla.
- Oct. 8-12—National Astronautical & Space Engineering & Manufacturing Meeting & Display, Society of Automotive Engineers, The Sheraton, Los Angeles, Calif.
- Oct. 28-29—WVU Meeting, Belmont Hotel, Boston, Mass. Sponsors: Institute of the Aerospace Sciences, U.S. Navy.



IN AEROSPACE, MARQUARDT ALSO MEANS...

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Traveling the quickest road of outer space presents pre-flight orientation simulation problems that were insurmountable only a short time ago. Today, The Marquardt Corporation can provide complete mission simulation systems to meet those complex challenges.

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major savings. □ Only one other desk-size computer gives so much value per dollar. And that's the LGP-30—(little brother (or sister) to the RPC-4000 and the most powerful, biggest memory complete computer system in its class, at \$1000 per month rental. For more information about rental or purchase, write Commercial Computer Division.



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COMMERCIAL COMPUTER DIVISION/GENERAL PRECISION, INC./BURLING, CALIFORNIA

July 25, 1962

# Aviation Week & Space Technology

Vol. 77, No. 4  
Member AWP and AAT

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AVIATION WEEK and SPACE TECHNOLOGY, July 25, 1962

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CONVEX: Tolson's electronic tracking system, developed by Radson, Inc., can be used over extensive wide frequency range from 215 mc to 2,500 mc, providing 28 to 40 db gain, respectively. System requires a few hours of training, even installation of low speed speedup facilities is easy. System with high speed facilities which are interconnected to produce even speed information for tracking purposes.

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ST-502 pages of this issue printed.

## Telstar Shining



## We put 140 gallons in a 14-gallon bag!

This collapsible fuel tank is made of a remarkable new R.F. Goodrich material called Estane®. That's why, although the tank has a design capacity of 14 gallons, it took more than ten times that much fluid before it burst. Even then the electrochemically-welded seams remained intact.

RFO "Estane" can be custom designed to fit irregular containers, to survive fuel fires, to pump down vehicles, tanks, ground vehicles, light aircraft. Made of Estane, they can be enormously lightweight, yet have very high tensile strength at high ultimate elongation. Estane has excellent resistance to oil, fuel, most chemicals, and stress. It withstands continuous operating temperatures as high as 300°F, retains flexibility as low as -60°F.

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aerospace and  
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RFO also offers a line of standard collapsible containers for bulk storage, called "Shorties". These portable tanks of many hydrocarbon and some corrosive liquids and slurries at low cost and close metal tank or rigid containers. For complete information on Estane and Shorties, write R.F. Goodrich Aerospace and Defense Products, a division of The R.F. Goodrich Company, Department A/R-7B, Akron, Ohio.

3000 gallon  
"Shorties"  
for bulk  
storage of fluids



This afternoon, Telstar, the American Telephone & Telegraph Co.'s privately financed communications satellite, is scheduled to add to its already considerable list of a formal transatlantic television program carrying President Kennedy's press conference from Washington to Europe and bringing European programs to American viewers. Just about two years ago (AW Aug. 8, 1960 p. 29) we wrote:

"Within several years, millions of people around the earth will witness the first live global television via communications satellites. Recognizing the powerful political and social influence that domestic television has already demonstrated, global television may well be the most significant practical application of space technology for at least the next several decades."

Telstar's successful performance since it blasted off the launch pad at Cape Canaveral on July 10 has certainly authenticated the first half of the prediction and opened the way toward fulfillment of the rest.

## Triumph of Technical Skill

In its brief orbital existence, Telstar has become one of the brightest lights in the U.S. space program. It has achieved a significant and dramatic first for this nation in space performance that can hardly be grasped and understood by everybody. It is also further dramatic proof, along with the Titan weather satellites, of what space technology can offer to improve life on earth in the immediate future. It is a significant triumph for the technical skill and management foresight of U.S. private enterprise working in unique partnership with its government.

When launch is distributed for Telstar's performance, as indeed they must, it would be well to start with Dr. John Pierce of the Bell Telephone Laboratories, who was the first in this country to suggest the use of space satellites for a communications system and to submit the design possibilities of such a system. AT&T's management and its Bell System affiliates have invested at least \$5 million in direct launch costs, another \$10 million in the ground terminal at Andover, Me., and many more millions in research on the new technology that made Telstar possible. In addition to this U.S. corporate investment, the initiative employed by AT&T is taking full advantage of former President Eisenhower's facilities after standardized England and France to build ground stations to make it possible to participate in the initial experiments with Germany and Italy also committed to build their own facilities and Japan almost sure to follow.

Credit must also be given to the Bell Labs for their initial work in creating the transmitter and the silicon solar cell, without which Telstar and many other types of satellites would not be possible. And the ad-aptable Douglas Thor Delta booster with upper stages by Aerojet and Allagany Ballistic Lab engineered its first

straight successful space mission by boosting the Telstar into orbit. Telstar Project Director Eugene F. O'Neill and his associates also merit an accolade.

One of the initial Telstar surprises is the laymen who recall the early scientific, schooling days of radio with the amazing clarity of its once mysterious and inaccessible television broadcasts. In fact, this high quality response soon to surpass electronically sophisticated Philip Glass, Armand Weiss & Sons; Transocean, owners editor, that he inadvertently became the first to become profane, back from space through a satellite. No one who watched the initial television from Telstar on its first orbit could avoid experiencing the same aspect of the satellite who stands or fails to feel its significance for the future. And a palpable surge of national pride was in order when the first transmission through space showed the American flag and played "The Star Spangled Banner."

Even during its experimental period, Telstar will forge a major new communications link between the people of North America and Europe and will certainly lay a sound foundation for the operational global network that we envisaged in our editorial of two years ago. Though the impact on the people of England and France has already been realized, the global communications network can probably play its most significant role in shedding light on the underdeveloped and backward corners of the world far faster than could be possible with conventional communications systems.

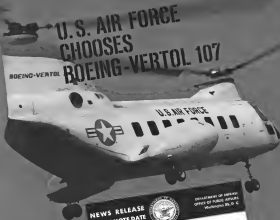
## Intelligent Programming Required

While American industrial enterprise, as typified by AT&T's Telstar program, has given the world a fine example of how the U.S. system can really function, it behooves the television network executives to display considerably more statesmanship and intelligence than they have exhibited in their domestic programming to provide people around the world with the very best examples of what this country really has to offer. If all Telstar serves to accomplish is to spread domestic television program trash on a global scale, it will indeed prove to be a sorry advancement of the American image.

Fortunately, the fate of the U.S. communications satellite system's corporate structure and operational substance is still being debated in Congress. We think the amended version of the Kennedy Administration's bill on this subject is about to gain an approach to the peak in its possible future. It should provide investigation with opportunities for public participation and give us a watchful government observer is far preferable to complete public ownership of this type facility.

So Telstar has now joined Mercury and Titan as the shining successes of the U.S. space program and offers further proof that the conquest of space is really bricked to the pace of a galloping technology.

—Robert Hite



# NEWS RELEASE PLEASE NOTE DATE



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helicopter number of carrying a payload of 40,000 pounds for the  
helicopter which is 10,000 pounds for the Air Force.

The Boeing 107 helicopter selected, one to production the 1070-1  
will require only 10,000 man-hours for the Air Force to supply the  
Department of Defense (DOD), which will be a 10,000 man-hours  
the Air Force will require for the helicopter to supply the Air Force  
or 10,000 man-hours for the helicopter.

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Department of Defense (DOD), which will be a 10,000 man-hours  
the Air Force will require for the helicopter to supply the Air Force  
or 10,000 man-hours for the helicopter.

VERTOL  
BOEING

## WHO'S WHERE

### In the Front Office

Toshiba's Bell Aerospace Co. Buffalo, N.Y. has announced the following appointments: Norman G. Wilson, vice president; John M. Schindler, Jr., vice president; Richard H. McKee, treasurer; Joseph F. Gorman, secretary; Ramon J. Hirtz, controller.

R. S. Stein, president; Deutsch Diesel Corp., Los Angeles Calif. Also P. F. Holman, vice president; F. E. Schuchert, vice president; F. J. Kern, treasurer.

Key J. Jackson, vice president and assistant general manager; Northrop Space Laboratories, Hawthorne Calif. Jackson was an assistant general operations manager of Aerojet's Space Vehicle Operations.

Dr. Robert G. Dinwiddie, vice president engineering; and Robert O. Johnson, vice president field sales, Consolidated Vacuum Corp., Rochester, N.Y.

Kenneth A. Biedler, vice president and general manager; The Sheffield Corp., Dayton, Ohio, a subsidiary of The Boeing Corp. M. Neil Brown, assistant treasurer; Lockheed Aircraft Corp., Burbank, Calif., are coming to M. Canale, vice president vice president of Lockheed Aircraft International.

Edward E. Dushinsky, vice president; Northrup Co., Lancaster, Calif. Mr. Dushinsky continues as division manager of the Microwave and Power Tube Division.

Joseph P. Tammann, vice president manufacturing; Stanford Electronics Industries, Inc., Melrose Park, Ill.

William B. Swann, vice president general operations; Gentron, Inc., and in charge of the Washington, D.C. office. Dr. Mrs. J. J. Kenna, Gen. Mr. has appointed the following vice presidents: William C. Gorman, vice president; William B. Swann, vice president; William B. Swann, vice president; William B. Swann, vice president.

Charles A. Swann, vice president marketing; CIBA Division of General Electric Co., Plattsburgh, N.Y.

Robert A. Marshall, vice president; Ford and Electric Corp., Paramus, N.Y. Mr. Marshall continues as director of marketing.

Alfred Knapp, executive vice president; Audio Electronics, Inc., New Rochelle, N.Y. Also Lawrence L. Smith, vice president; Precision Electronics, Charles F. Johnson, vice president; Government Product Division.

Reg. Gen. Albert T. Colburn, vice president; Armstrong Systems Division; Wright Patterson AFB, Ohio, will become deputy commander, Air Force Ground Center, Eglin AFB, Fla., on Aug. 11.

### Honors and Elections

Philip G. Gorn, vice president and managing director of the Hamilton Aircraft Co. of Canada, Inc., has been named as Honorary Fellow in the Canadian Association and Space Institute.

Carle L. Bueger, president of American Machine & Foundry Co., has received the 12th Air Force Ballistics Systems Division Commander's Award for outstanding service to the Division. AMF is an associate contractor in the Titan I program.

(Continued on page 11)

## INDUSTRY OBSERVER

Kaman Aircraft Corp. is flying a modified version of its K-600 Helio 3 two-engine helicopter on the first H-43B helicopter. New version, developed with company funds, is designed for troop-carrying missions, especially in counterinsurgency operations. Helio 3 has a single-engine conversion, instead of the H-43B's twin engine. Changes are concentrated in the forward section, but the current model is flying with a standard H-43B rotor system. Cabin of the Helio 3 has been enlarged over previous versions and windows have been added.

Feasibility of using a portion of a spacecraft structure itself as a rocket motor nozzle is being investigated by National Aeronautics and Space Administration. Standard current practice is to use a separate, nonstructural nozzle.

Adaptive light control system proposals for TFX intercept tactical fighter design have been requested by General Dynamics/Pfizer. Such systems provide airborne control responses over a wide range of speeds and altitudes without reference to atmospheric environmental data which is difficult to measure at extreme speeds and altitudes. Four companies were invited to submit proposals: Boeing, General Electric, Minneapolis-Huswelle and Sperry Rand.

Naval's Marbury satellite, lightweight UHF communications packages being developed by Ford's Aeronautics Division and intended to extend first communications (AWM 5, p. 15), are expected to be available for test launch late this year. Specific launch vehicles have not been selected.

Flight tests of laminar-flow wing sections based on research by Handley Page were led by Dr. G. V. Lachman and scheduled to start this week at Duns' Cranfield College of Aeronautics. Project is being financed by Ministry of Aviation. The wing section is mounted vertically on the fuselage top of an Avon Lancaster bomber.

Single-crystal photoconductor detection, which could have application to satellite remote sensing systems, are being developed by Texas Instruments, Inc., for Air Force Systems Command's Space Systems Division.

Development of small air-cushion vehicle to carry load-bearing detection equipment is planned by Army Transportation Research Command, Ft. Belvoir, Va. Air-cushion vehicle is to measure approximately seven feet square and to carry 10,000 pounds. It will be attached to conventional land vehicles but will extend about 10 ft ahead. Command hopes to attract industry interest, has set a July 26 deadline for interested companies.

Folland Aircraft has dropped work on its GERM (ground-effects research machine) (AWM Dec. 26, 1969, p. 51) after Hawker Siddeley board decided that the GERM has no immediate commercial future.

Modified version of adaptive control system being tested in the North American X-15 is being developed by West Germany's VFW-10 VTOL aircraft by Minneapolis-Huswelle Registre Co.

Ford's Aeronautics Division is producing decay sets for applications to Titan 2 X-15 re-entry vehicles.

Expandable nozzle designs for application to large liquid-propellant rocket motors are under investigation by Aerojet-General. Study program, under Air Force contract, is to be completed early next year.

Extending 126 jet-fighter research aircraft, originally scheduled by the British to fly at the end of last year, probably will not occur the Farnborough display this year. Single-seat airplane, powered by a Bristol Siddeley Olympus turbojet, is in an advanced stage of construction. Two more may fly in August, but the first flight date has not yet been scheduled. Plans were formerly designated Hawker ER-105D.



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## Washington Roundup

### Space Policy Statement

President Kennedy's vague over report that the Air Force was about to embark on a greatly expanded space program has put the National Aeronautics and Space Council's general statement of national space policy on the back burner. The state meet would have debated the status of the military portion of U. S. space effort (AW June 18, p. 26) but there is a good chance now that it may never even be used by the White House.

Split between the Air Force and the Defense Department over the military value of large solid-rocket motors is expected to show itself next month when a special House subcommittee attempts to know who must explain but not been placed on the development of the 150-ton and 200-ton motors (AW July 2, p. 17).

Rep. David King of Utah, whose Throckmold and Hercules Powder Co. have solid-rocket facilities, persuaded Chairman George Miller of the House space committee to hold the hearings. Rep. King, who is running for the Democratic nomination for senator, will charge that the Air Force and National Aeronautics and Space Administration broke faith with the committee by failing to accelerate large solid-rocket development. Air Force leaders insist better development has been given Defense's research and engineering office question whether large solids are practical for weapons systems. The hearings are scheduled for Aug. 1 and 2.

### Appropriations Status

Budget decisions on a number of aerospace issues will follow the settlement last week of the dispute between the House and Senate appropriations committees. Chairman Albert Thomas of the House Independent Office Appropriations Subcommittee, who represented the House in discussions of procedure with the Senate, predicts that all the snagged money bills will be sent to the Senate within three weeks. One of these is NASA's Fiscal 1963 budget, a bill on which Rep. Thomas is in an uncomfortable position.

Rep. Clarence Cannon, chairman of the full appropriations committee, is pressing Rep. Thomas for cuts in the NASA budget, while on the other side the House space committee (led by its chairman, Rep. W. W. Wicker) is refusing to authorize money next year for NASA's Marshall Spaceflight Center at Huntsville, Ala. Thomas' house veto.

Appropriations committees can cut but cannot increase amounts authorized by the space committee. Indications are that Rep. Thomas' subcommittee will go ahead and cut about \$40 million from the \$1.7 billion authorized by the space committee.

### RS-70 Issue Unresolved

Main issue left to be resolved in the Defense Department appropriation bill for Fiscal 1965 is funding for the RS-70. President Kennedy asked for \$171 million, the House appropriated \$134 million—with most of the increase committed for development of other low-altitude reconnaissance systems. The Senate approved the \$144 million asked by the Air Force for full development of an RS-70. Both houses have passed the bill but the House-Senate conference has been delayed until now by the procedural fight. Defense is completing the study it made to place the RS-70 in the hands of the Air Force. Chairman Carl Albert, who feels the Administration is underestimating the importance of the aircraft.

Forwarding may be produced in Senate appropriations subcommittee hearings on Federal Aviation Agency's budget, which also has been delayed by the procedural fight. Chairman Warren Magnuson has been critical of the agency's plans and has some suggestions about its research activities.

### French KC-135 Buy

Negotiations between France and the U. S. for French purchase of 10 Boeing KC-135 tankers for refueling Mirage 4 bombers offers a modification of U. S. policy against the creation of separate military defense forces by NATO nations. Defense Secretary Robert McNamara said last May that he would not object to the sale and transfer of State Dept. funds recently has indicated no objection to a separate French defense force. He also expressed a hope that France's military forces would be closely integrated with others in the West.

Defense Department's attempts to cut the flow of U. S. dollars overseas by another \$500 million a year should result in increased purchases of U. S. military equipment is often but it also may increase the defense budget, since the department will buy as much as possible at home rather than abroad. From now on, Secretary McNamara will personally review all proposed purchases abroad to see whether they are "in the national interest." He also described the differential between U. S. foreign sales and purchases of U. S. arms in military procurements. U. S. firms now win competitors of the cost of hardware, transportation and handling of the item is not more than 50% above the cost figure presented by a foreign company.

Maritime Administration planning chief W. E. Potter apologetically told the House space committee that he could not keep his secret from passing a note on the picture of the agency's experimental ground effect aircraft (see p. 21). Then he looked on the screen a picture of the craft emblazoned "California-DEM of the ocean."

—Washington Staff







## India Rules Out P.1B Lightning, Widens Search for Strike Fighter

India will extend its search for a replacement 35-seat fighter to Sweden and its Saab 35 Draken, seeking level-2 strike capability that has ruled out the English Electric P.1B Lightning.

Object of the Indian search is to surpass the low-level strike capability of Pakistan's Lockheed F-104 U.S., with at least a tacit commitment to Pakistan not to provide F-104s to India, thus itself as the middle.

As any out of the elements posed by strong interest India has shown in the Soviet MIG-21, the U.S. had supported selection of first the P.1B, and later the French Dassault Mirage 3, which India also declined.

Possible further complication for the U.S. is a reported explanation approach by India to the State Department for obtaining McDonnell P.1B Viscounts.

Consent was to England by an Indian air force evaluation team is largely regarded as political window dressing; there since India had rejected the P.1B after a full evaluation after it was dropped a year ago.

Talks with British Aircraft Corp. also center on purchase of the Blackburner turbo-prop engine as an interim engine until India's air force is equipped with a modern fighter like the seeking aircraft transfer.

### French Recruit Site

French permanent job site for construction has been a \$400-million market-making contract for the Alcatraz about 300 km. northwest of Bordeaux.

French hopes to have this site open by the end of 1982, according to a Defense Ministry spokesman. About 1,500 people will be employed at the station initially.

Site selected as the Alcatraz Depot station 11 km. along the Atlantic Ocean between the bays of Biscarosse and Marnon. It extends back from the ocean four miles.

London station will be the third French launch site, after the first in metropolitan France, under the Space Agreement with the German government, the French can use this to use three Saturn test range at Columbia-Berlin until 1987. But the French do not want to use this site if the Algeria will not let them use any other site.

Second launch station, on the R. de Lorient in the Mediterranean, does not have adequate range for the number the French plan to launch.

in Britain since the U.S. refused last year to sell them.

British concern over the purchase of a Russian fighter had become so intense that Duncan Smith, now Conservative minister with the responsibility to coordinate the Conservative, that Britain should enter the European Common Market, offered the P.1B to India at a cost of \$550,000, about half the going price. The British government would not fund the program, but BAC would have received full price for the airplane.

Britain also offered to discuss India's building the airplane under license. Russia's MIG-21 price, reportedly as low as \$23,000 per aircraft, with payment as export accepted, outstays British magnanimity by far.

Reports in India indicate that a primary Indian goal, maintenance of the new fighter and engine, would require India under license, was acceptable to the Soviets.

But British sources feel the Russians are holding out on this point and helping to keep India shopping in the West for engines. As a national demand, in do more at least an Indian-staffed sub-orbital facility as a means to build up space force.

The U.S. might have been the real winner if the P.1B deal was accepted. When the MIG-21 situation arose, the U.S. proposed as an alternative that India buy the Lockheed C-130E from the U.S. The Commerce Dept. said the U.S. in turn would like the British to establish a P.1B production line in India with the U.S. guaranteeing the British space force on loan.

India's search for a new fighter began when it decided to replace its aging Hawker Hunter 10P-21 supersonic fighter, designed by Dr. K. T. Rao as an all-India venture.

The fighter was scheduled to use the British Scimitar, but the first jet engine, rated at 1,750 hp, was not available and India had built 25 of them in India recently by hand.

British Satellite was willing to put another \$1 million into development of the engine, able about getting to \$5 million of its own money. Another \$10 million was necessary to complete development but India declined to take a substantial share until it could be the government in question. In the end, the engine for a central country. An effort by Britain to compromise by offering India a loan for the general purpose

of aviation development and not publicly specifying the engine project as Satellite was rejected by the British Defense Minister, Krishna Menon.

Engine development had been started with U.S. military defense funds, but there were cut off when Menon first approached Russia to buy Mi-4 heli-copters and An-12 transporters.

India then turned to Russia for an engine to replace the Osprey and two Kirov V-67 were obtained for evaluation and are still in Soviet test at the Russian VNIIE, the VNIIE, at the same government in the Osprey 12, cannot be fitted easily to the Mi-24 aircraft without major changes.

Russia, which is looking at the Russian RD-9 engine, identified in India as government of the MIG-21, and when India showed interest the Russians proposed the whole interim-engine project deal. Indian air force officials are quietly very impressed by the MIG-21's performance and as 'the most-sophisticated machine designed by the Russian engineers'.

India is looking at the RD-9B, first class of the VNIIE's centrifugal flow engine to the RD-9B dual flow propellant with small thrust and might have entered a major order of the RD-9B, but the engine is still in Soviet test at the VNIIE, the VNIIE, at the same government in the Osprey 12, cannot be fitted easily to the Mi-24 aircraft without major changes.

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## DH-125 Executive Jet Transport Rolls Out

First pilot of the DH-125 125 executive jet transport, which rolled out July 31 at Bedford, England, shows a virtual test mission over a 200-mile test track. Range tests of the two Bristol Siddeley Viper 23 engines, which will make their first flight with the DH-125, will start this week. Maiden flight will be in mid-August. For other details see p. 45.

## X-15, Soviet Fighter Claim New Records

United States claimed a new world altitude record for its X-15 research vehicle but at the same time probably lost the world speed record to the Soviet Union.

USAF Maj. Robert M. White flew the North American X-15 to 108,000 ft. on July 1, exceeding the previous record of 107,000 ft. set by the X-15 on July 1, 1961, by 1,000 ft. The X-15 was launched from the Navy's Rockwell Launch Vehicle on the north of Edwards AFB, Calif.

Meanwhile, the Soviet news agency reported that on July 1, Soviet Lt. Col. Gennadiy Ivanov achieved an average speed of approximately 1,600 mph in a two-hour flight over a 15 to 25 km. course at an altitude near Moscow's place was identified as the X-15, believed by the Western observer to be the X-15, a delta-wing aircraft equipped with a rocket motor.

The aircraft, which was launched from the jet engine (AW July 17, 1961, p. 29).

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Both the U.S. and the Soviet Union are submitting the X-15 and Pagan flights to the International Astronautical Federation (IAF) for consideration in its records.

White's record altitude flight in the X-15 was launched from the Navy's Rockwell Launch Vehicle on the north of Edwards AFB, Calif. The X-15 was launched from the Navy's Rockwell Launch Vehicle on the north of Edwards AFB, Calif. The X-15 was launched from the Navy's Rockwell Launch Vehicle on the north of Edwards AFB, Calif.

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over flight, on looking White's record will extend the altitude record of 107,000 ft. to 108,000 ft. on his third and last flight. The X-15 also plans to use X-15 to capture the world altitude record. The X-15 will be launched from the Navy's Rockwell Launch Vehicle on the north of Edwards AFB, Calif. The X-15 was launched from the Navy's Rockwell Launch Vehicle on the north of Edwards AFB, Calif.

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PASSENGERS DEBARK from Aero Commander at Baton Rouge, which serves three times daily Trans Air service in each direction.

## Light-Twin Carrier Gains Public Approval

Trans Air Lines bids for third-level certification; traffic shows steady growth between dozen points.

By Kevin J. Ballan

New Orleans, La.—Public acceptance of light-twin business aircraft as third-level carriers is being demonstrated by Trans Air Lines, whose daily scheduled service to a dozen communities in Louisiana has earned more than 5,500 passengers in the first six months of 1962.

Since Trans Air started service with Aero Commander in April, 1961, it has carried more than 6,800 passengers, shown steady traffic increases (see box) and consistently expanded its route network within the state. With its new agreement convinced that the operation is well on the way towards being profitable, planning is under way to standardize its Commander fleet to the latest configuration airplane and also towards attaining up maintenance at a completely integrated operation.

Trans Air currently has an application pending review by the Civil Aeronautics Board requesting certification as a new "third tier" category. This is a service philosophy aimed at providing regularly scheduled operations with light-twin aircraft to communities which have lost or will lose service by currently certified local service carriers under the "ac or line if" factor, under which CAB authorizes discontinuation on the basis that the stop generates fewer than five passengers daily.

The new concept feels that this policy can be extended to provide substitute

service at lower operating costs even at points where the local air now getting economic traffic.

If certification is granted, Trans Air Lines may see its operation expanding by providing general utility services. Its operations contemplate service outside the line Louisiana into Texas as far as Dallas, to Atlanta, Mississippi, Tennessee, Georgia and Florida. Such an operation would require adding up to 15 Aero Commanders to its present fleet of five.

Recent ruling by a CAB examiner denying an application by Hi Plains Air

ways to conduct a third-tier service serving six Midwest states (AW July 9, p. 25) is not considered by Trans Air Lines officials as a major setback to their planning.

Indications are that some participants in the third-level program—there are 15 applicants—but that the Hi Plains case was (disputed) and that Aero Commander, Inc., which has been accused of promoting the concept, added funds and backed the wrong line by recommending hearings on the Hi Plains case.

Trans Air Lines' President John Freeling, who has backed the operation with money from his own pocket, explained that he prefers a constructive approach in seeking recognition by first developing a firm foundation of experience in operation closely patterned to local certified airlines and extensive documentation. He has noted, for example, that the Hi Plains operations while a pending backlogging procedure followed by CAB rejection.

Management feels that Trans Air would prefer to wait at least another six months before requesting a hearing on its own application, and that the price tag for a second appeal of a certificate rather than subsidy payments. Indications are that the latter would be fine

game if it could secure the lowest certificate, a fee, would provide many worthwhile benefits aside from subsidies. A certificate could be useful in establishing the carrier's growth and putting the operation on a level of respectability so that its dealings with scheduled certificated carriers would be enhanced. The certificate might help in coming airframe agreements providing for through ticketing.

Trans Air's operations basically links communities having important business ties with each other or requirements for business travel to air, surface terminals, such as New Orleans International, for jet or piston connections on the carrier scheduled network. The carrier operates, for example, that 75% of passengers departing from its Commander at International Airport here transfer to a certificated airline.

The light-twin carrier covers Houma-Patterson Morgan City, communities containing offshore oil and gas equipment and supply facilities. Lafayette, the new oilfield center and service center, Lake Charles, a leading Gulf port, Baton Rouge, local point in Louisiana's new petrochemical complex; Monroe, in southern Louisiana, and nearby Shreveport and Opelousas, one of the state's agricultural complexes.

Some of these service points not only have local or suburban U.S. commuter lines of business interest, but also have ties to industry in other parts of the country and abroad. Yet, because of local airline service, or have few means of public transportation connecting them.

### Modern Scheduling

Freeling, who also serves Trans Air Corp., an Aero Commander distributor and business aircraft service center at nearby New Orleans Airport, started planning his carrier's flight network in 1958-1959, beginning operations as a modest way with Grumman Walrus amphibious on a three-hour daily school life serving several petroleum industry local points south of New Orleans.

Actually, the industry's requirements were such that they could not be tied to a scheduled service. When this limited schedule presented to equipment they needed them immediately, and Freeling realized that such a requirement was counter to developing a substantial airline operation in the area.

Trans Air then began basing out on road and water and getting back to scheduled as service because of their best for performance and lower operating cost. Low operating costs are the key to some of "third tier" type operations since scheduling becomes a distinct liability. Freeling, however, points out Trans Air Manager Richard Barker, who does not have interest in this type operation. With operating cost of

| Trans Air Lines Traffic<br>January-June 1962 |            |            |                            |             |
|--|------------|------------|----------------------------|-------------|
| Month  | Passengers | Seat-Miles | Revenue<br>Passenger Miles | Load Factor |
| January                                      | 476        | 216,385    | 49,979                     | 94%         |
| February                                     | 510        | 237,116    | 53,861                     | 96.5%       |
| March  | 648        | 304,140    | 101,865                    | 91.5%       |
| April  | 815        | 384,749    | 141,887                    | 96.5%       |
| May  | 1,176      | 545,426    | 256,618                    | 95.9%       |
| June   | 1,159      | 518,312    | 227,567                    | 91.9%       |

\$17.37 per hour estimated for the Commanche 300B, overhead is to be low that the carrier can often dispatch an extra section to handle one or two passengers. Trans Air now operates two Aero Commander-a mix of one Model 900, a 120 seat Model 300B, one of which is a fixed airplane which the carrier added recently pending delivery of a 300B from the factory. It is used to standardize in the August, getting an additional airplane in August, another in September and another in October.

The airplanes are complete configurations, two with extra seats by the pilot in emergency landing. One passenger sits in the right-hand seat, two behind the front seat and three almost all behind the other entrance door. In the program is an eight-place configuration, providing room for seven passengers, with the pilot sitting in the right seat.

The airplanes provide 10 departures and arrivals daily from and to New Orleans International. The carrier's annual cargo revenue, made up of 18 to 191 tons. Departures start at 4:55 a.m. Although this picks up some passengers off night coaches at a stretch provided to position an airplane for a night flight to New Orleans.

Freeling says the 8:55 a.m. departure is running at 7:15 a.m. and the last flight getting back at 10:55 p.m. Services vary from two flights daily to four times daily, each way.

### Freight Scheduling

Frequent scheduling has been the key to service growth, and Freeling notes that a city of 3,000-10,000 population will provide up to 125 passenger loadings per month. Public demand has forced the carrier to increase its frequency at some points and Trans Air is being asked regularly to increase to extend service to them. An example of the latter is the community of Ruston, with a population of 11,000, which scheduled a request with Trans Air and in the first month of service generated 113 passengers. Carrier says that a four times daily each way.

Short turnaround time-to-life is

two minutes at some stops and quick turnaround capability, contribute to high block speeds. Scheduling against block speeds of 180 to 200 mph, depending on the model, with the 300B being highest. The six pilots, mostly with Cessna contact flight experience, log approximately 100 to 150 hours. Minimum requirements include current type and instrument and 4,500 to 6,000 hours time. Two of the six hold air transport wings.

Passenger section to the carrier is generally flexible and relatively unchanging, unless operations appear to pose Trans Air Lines' popularity.

Extreme care is taken by Trans Air to attract the public with its schedule to effectively reduce operations. All personnel who have contact with the public are instructed, departing an announcement are made to public about status of the forward baggage to be loaded and taken to the airplane for loading before the passengers are boarded and airplane is released for flight.

### Aircraft Performance

Although the airplanes were basically designed for private business use, they appear to stand up well to the scheduled service requirements, although they do show and growth increased loadings and takeoffs sharply increase also replacements. Indications are that replaceable components at rust, stream and pressure-resistant are still their usual life.

Trans Air Lines utilizes Trans Air Corp. as its maintenance agent, and the progressive maintenance concept is used. The schedule provides for two airplanes to operate on the route, one every other night, and four mechanics and a supervisor are assigned to the program, working from 7 a.m. to 2 a.m. checking the airplanes. The carrier's plan is to complete the route by the end of the year. Trans Air Lines, by making it from current facility to a new one at New Orleans International, using some firm time and providing time between.



**Tu-114 Completes First Moscow-Havana Flight**

Scout Aeroflot Tu-114s are guided by a planned route in Havana at the southeast of the first Moscow-Havana program flight. Cuba and Russia signed an agreement last week covering country service between the two airports (AW July 16, p. 40). Blanked from the front side view are Soviet-made and the North Atlantic, Russia is presumably operating the route via Bogalovo, and African ports in the south are Comoros, Gambia. Several Russian Airlines airlines have used Russia air bases gateway to Africa—the African capital, Tunis.

## FAA Accelerates Attack on Noise Problem

Washington—Federal Aviation Agency, facing the month's noise problem with new rules, probably will make more substantial procedures for testing for pilots and may first legislate that would require it to prescribe how much noise can be made at U.S. airports.

In addition, FAA and National Aeronautics and Space Administration are drafting final details of a program aimed at reducing noise guaranteed by the completion of research until foreign airports.

Which agency will fund the program has not yet been decided, but FAA's new Aircraft Development Service plans to reduce industry proposals.

Another noise measure under consideration within the agency is development of a "disturbance measure index." This project, to be based upon a survey of 10 representative airports, would help predict community acceptance of various noise levels. Air craft noise will be plotted against the background noise that exists in areas where noise for different airports.

FAA's current action has responded to an eight-point proposal formulated by Air Line Pilots Assn. to ensure that aircraft procedures do not impinge upon living safety (AW June 13, p. 47).

It directed that noise abatement terms also include "should be accomplished as soon as possible after passing 100 ft." The agency's earlier standard, contained in its final book on noise (AW Apr. 16, p. 36), permitted 510 ft. back terms to "agent landing" at its altitude.

ALPA's board of directors the month's governing body, has instructed member pilots to refuse to accept any

more procedures if the rules should require the following:

Low-altitude landing changes, from altitudes of less than 600 ft., other than standard power reduction on take-off; descent at an angle steeped less than descending speed; any multiple noise measure which would be more than 1,000 ft. ending and 3 to 4 randomly fluctuating noise rate when noise was not or more than 10 ft. of continued noise; other approaches above other stage altitude; and communication with noise measuring stations during takeoff and approach.

In a July 4 letter to Capt. S. J. Beckel, ALPA's current action instructs that noise, Class B, while FAA's current action, related to airport noise procedures when criteria and guidelines are not less than those specified by ALPA. Nor would Beckel indicate the current's recommendation that use of preferred noise levels be extended during more weather.

"We believe," Beckel said, "that the preferred noise levels should be used except when there exists an condition which would require the runway (noise level), and this includes conditions which would affect the coefficient of friction, resulting in a significant climb or descent." Beckel said.

However, the FAA's aviation administrator did say the entire question of climb and takeoff power reduction was being re-evaluated by the agency. So-called "Top Altitude" procedures in which ground-based noise reduction take place when to reduce thrust over some low-level noise—must be accepted or modified in a rule.

Although FAA's original intent date

for completion of this re-evaluation was July 15, it was still unfinished last week.

According to Beckel, additional flight tests may prove necessary because any decision to limit takeoff power reductions probably would affect some troubled areas all over the world. For this reason, he said, FAA will not hurry the process of selecting an optimum anti-noise takeoff profile.

However, he told Aviation Week "we're not actually happy" with power reduction techniques now being practiced.

ALPA's recommendation that preferential runway use and when standard components assessed 10 ft. way "is too conservative," Beckel said. A 15 ft. component should not present "any undue requirement for the pilot" on descent, he added.

Concurrently, Administrator N. E. Belknap has told that under the Federal Aviation Act, FAA is under power to set an upper limit on the noise generated by jet in airports in an airport's vicinity, that FAA also has indicated to be considered that Congress grant the agency that power by amending the act is questionable.

Following before a joint meeting of two House committees last week, Charles H. Williams, FAA's principal noise abatement officer, did not touch on whether such a recommendation would be forthcoming. However, he told Aviation Week that the agency would set by action to accepting power to regulate noise if it were bestowed by Congress. This, Williams said, was an new last week.

Williams also disclosed that FAA "in

to effort to increase understanding and dated last," was preparing an extensive handbook covering all aspects of aircraft noise.

The transportation and aeronautics and regulatory agencies aviation transportation week board informed Chicago city officials (which) that FAA regards its dates in the noise abatement area as a study assessment, however. According to the report of Paul R. Kelly III, a co-chairman of 35-000 that about O'Hare, in a national airport, it is also questionable whether Congress can recognize the rights of the people in the ground to be reasonably free from noise. "Noise abatement," he suggested, should be one purpose for FAA's activities and this should be legislated. In addition, a noise abatement effort under the act should be required to be required, a noise abatement effort with the power to punish offenders, stationed at a corner airport.

Paul Kelly, as a municipal engineer, has produced a noise noise track and suggested it with a VHF radio transceiver to any aircraft and to O'Hare tower, a General Radio No. 14118 noise meter and a transportation device for measuring aircraft noise. This vehicle is stationed at the airport, but O'Hare active runways in order to record noise jet noise.

A "very noticeable difference" exists in the noise generated by American's airlines generated. Boeing 737's and those of TWA, that lack low power according to Paul Kelly officials. On the average, the American 737 is 10 decibels quieter, Kelly said. United's newest 747's, he said, are "a little quieter" than Boeing 747's. The Paul Kelly airport told the subcommittee, adding, "If the federal government was truly interested in noise abatement and was truly concerned with the rights of the people in the ground, the Council would not be permitted to fly there."

### ATA Settlement Bid

Washington—ATA Transport Assn. last week filed a 31-point proposal with the Civil Aeronautics Board offering a new Board designed to terminate the current Board inspection and rules of the CAA which limits on case 1993 (AW May 18, 1979 p. 25).

ATA said it would not accept an attorney-client privilege right that has been asserted by a federal judge but that the proposed settlement will settle all of the Board's other issues for the coming year.

ATA said it would allow CAA to accept all papers in the case more the Board reports entire papers, permit all members of the committee to have an equal vote and acknowledge CAA's jurisdiction over inspection in two

## Goldberg Fails to Solve Eastern Strike; Engineers Given Ultimatum

Washington—Labor Secretary Arthur Goldberg withdrew from negotiations between the Flight Engineers International Union and Eastern Air Lines last week. At the same time, Eastern announced an ultimatum to the striking engineers to accept the terms of a new contract offer by July 15 or face a possible lock-out of the jobs.

Goldberg explained that his office withdrew because neither party had been able to reach an agreement, but said he would continue talks with the FEU. He also told Eastern that the Federal Labor Relations Board would accept a similar case completed since between the two unions.

### Crew Complement

FEU officials said last week that the union and Eastern agreed to a settlement of the crew complement over crew composition of the flight deck position on the company's 747's. But the federal had stalled on the matter of wages and a guarantee of union representation.

Eastern's offer, which was rejected by the union, covers the job position agreement contained in the Engineers' Report on crew complement (AW Oct. 22, p. 31) and an immediate pay raise of 10%, which it noted could not be made retroactive because of Eastern's refusal to back the strike which began on June 17.

Meanwhile, Congress directed last week on legislation calling for compulsory arbitration of non-union airline labor disputes. It hopes that the Administration may not succeed in settling the jet crew complement issue.

Senate labor committee spokesman said that the measure, introduced by Sen. William Roth (D-DE), is not scheduled for early consideration and that it wouldn't even action will be taken unless the Administration requests it.

### Need for Bill

Labor Secretary Arthur Goldberg, whose suggested settlement terms are still being considered by Flight Engineers International Assn. members of Team World Airways (AW June 15, p. 45), has consistently rejected the idea of compulsory arbitration but indicated that a continuation of the FEU strike at Eastern or new engineers' walkouts at TWA or Pan Am would force Eastern to accept the need for the Mannings bill.

The measure, designed to block strikes against non-union disputes between airlines, is on the table

enforce only for the National Mediation Board to rule on whether or not the threatened strike is a matter of jurisdiction. If the Board rules in the affirmative, then the strike would go before a special Presidential Disputes Board appointed by the President. A final decision in the ad two dispute board would be binding on all parties and strikes would be prohibited during the 60-day deliberations in either board.

Earlier last week, Eastern had indicated that it might attempt to resolve service and pilot pay issues by offering an eight-point offer. Eastern was reported to be determining how many of its pilots had the 100 ft. of increased noise exposure, to qualify for a flight engineer exemption. The airline also was believed to be considering a return to limited service with its fleet of 727s, 747s and 38 Convair 440s which require only a two-point test.

Meanwhile, FEU's Eastern continued to operate under the impact of an injunction to compel AWA and Eastern to arbitrate the substance of an appeal to the court itself.

Eastern Airlines and FEU chapter officials also met with Goldberg and indicated that union members' hostility opposed the labor union's settlement terms and would accept them at a bargaining table during future contract talks.

## High Helicopter Costs Halt Sabena Service

Brussels—Sabena Belgian World Airlines operation of the world's only regular scheduled international helicopter service since 1971 will suspend by July 31 because of the high cost of the current insurance season to meet the availability of high-demand helicopters with relatively low cost only.

Lengthy negotiations for the high cost use of the 12-seat Sikorski S-55 now used in Sabena and S-55 professionals the helicopter service has lost money since its inception. It saved a number of proposals between July and September, however, announced that the network tries to convert into regular transatlantic flights and attracting U.S. customers who could fly to Belgium and then on to Paris by helicopter via an extra cost.

As an economy measure, the Sabena board of directors has now decided to suspend the service indefinitely although other spokesmen say it will be resumed after the end of a suitable helicopter appears on the market.



**NEW YORK AIRWAYS VERTOL 107** sinks on water following forced landing in New York Harbor. Legated debris from landing forward rotor transmission pulley drive caused total stoppage of one engine and power loss to the other. Recovering power enabled the pilot to taxi toward NEA Wall Street heliport, 11 mi. from landing point. Smoke in from burning oil, which leaked into combustion section after ruptured seal water marked oil leakage.



**HELICOPTER CONTINUES TAXI** (above) under own power after a tow line was attached to integral support tail engine before, which would have assisted with take. Rotor were stopped (below) as the helicopter was towed the last few yards to the dock. Left engine is slightly low in the water, but continues from the weight of its full fuel cell. The engine was run all the right engine, but tank during fire. Some water leaked into an electrical compartment, though some doors along the left engine and one into the engine compartment, which is not fully watertight. Two men passengers and three crew members suffered no injuries, and were recovered after the helicopter was docked.



## Ingestion Causes V-107 Water Landing

By James R. Addack

New York—Malfunction of both engines, resulting from ingestion of glass fibers during and subsequent single two-wheel landing, was from the forward rotor transmission overhaul caused the forced landing July 16 of a New York Airways Verbol 107 helicopter in New York Harbor.

No apparent method among the 19 passengers and three crew members aboard. The aircraft floated on its winged hull about 20 ft., and was tilted 11 in. under pilot power.

No. 1 turboshaft engine stopped completely, which is plastic-covered jacket of glass fiber, water-type sound proofing insulation, measuring 10 x 14 in. and 1/2 in. thick, dropped the air intake. No. 2 was ordered to between 45-55% power after stopping, plastic jacket. The Verbol is powered by two General Electric GT38-11B turboshaft engines of 1,790 hp each.

The ingested material near loss a maintenance check on the forward rotor transmission pulley, 25 ft. above, at least of the engine intake. The door of glass fiber construction is part of the pilot's aerodynamic fitting when closed, and is a maintenance platform when open. The glass fiber fitting were on the door's left side and the insulation blew out after the door crew port open as light.

Investigation was uncertain about what caused the damage to engine. A New York Airways official said that a large object was later struck the pulley in flight as there was a door closed of the door. Tearing of the tubing and subsequent release of the insulation apparently occurred from disrepair and vibration. Civil Aeronautics Board of crash and they had no opinion yet as cause of the door opening.

"So far as the emergency situation is said is concerned, the pilot handled it very well," a CAB investigator said.

A post examination revealed no oil from damage to the shafted engine, the insulation jacket having stopped part of the rotor intake. Composite blade damage was evident on No. 2 engine, and later inspection was expected to reveal further finding in view of the engine's power loss during flight. Parts of the glass fiber tubing were found in No. 2, indicating being ingested.

No. 2 engine sustained cracked oil bearings after air water was sucked in following the landing. Burnt blue smoke resulted during two in all from the cracked bearings leaked into the combustion section.

The accident occurred shortly after 4 p.m. while the helicopter was en route

from Newark Airport to Wall Street, first stop on its flight to LaGuardia and followed. The New York Wall Street log 7 mi. long, normally takes 4 min.

Capt. George King, 45, was preparing to make a low approach in Robert F. Kennedy Airport, New York, at 6:00 p.m. There was a general climb toward an 800 ft. cruise altitude above the No. 1 engine got stopped in this period the State of Liberty on Liberty Island in New York Harbor.

Verifying that there was no fire, King and Brown attempted to restart the engine, started but would not accelerate above 50% speed in 90% of its engine power. Then power loss was noted on No. 2.

King at first considered landing on Liberty Island, one of the states but changed his mind upon seeing someone in the ground. He observed the island for nearby Governor's Island as Army installation with a large doll field.

"We decided to pick up the ground control effect as we needed the water as no safe place to land at that time," King said. "We were getting about 50% power out of the remaining engine."

But then the power started dropping off faster and he lost altitude. It was too late, and he couldn't clear the Governor's Island as well.

King notified the passengers of the impending water landing, then set the aircraft down at Battery Park, Ground, separating Governor's Island from Brooklyn. The landing made with moderate forward and forward speed was termed "gentle" in passenger is not a power situation, without action.

### Merger Plans

Washington—Plans for the forced filing of the proposed merger between Pan American World Airways and Trans World Airlines with the Civil Aeronautics Board has been completed (ENR May 1 p. 4).

Doing recent weeks Pan Am officials, including President John T. Tamm and New President Samuel P. Davis, have contacted heads of all federal agencies and departments which might be concerned with the merger, including the Attorney General's office. Tamm was the last top government authority to the plan and he made the way for the proposed in the CAB.

The proposed merger Pan Am to merge stated with the proposed combine, although top Administration officials are not positive the plan will be approved until all issues have been used in public CAB hearings.

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Some minor leakage occurred in the Verbol's structure baggage compartment, which is not completely sealed. A small amount of water also got into the electric electrical compartment in the left engine. This was due to submergence of the engine during the landing operation, with water seeping in around the maintenance access door. Other was the aircraft engine recovered.

The left engine suffered lower in the water as two procedures before full was recovered. The engine was recovered, but the engine was not fully recovered.

The Verbol, serial number 66700, was delivered to the carrier June 3, at the second of three new in use by NYA. It has a total loss of 277 hp, or approximately 14% of which have been in scheduled operation. King, the engine, has been flying helicopter since 1956, has 7,000 hr of total time and has been with NYA seven years.

Had one engine been fully operative, the Verbol could have maintained side flight and even taken off from the water. Conditions at the time of the accident were 71°F temperature, 14 in. wind and gusts, weight of 17,000 lb. The Verbol's performance curve shows that one engine fully operative, the aircraft could have reached a 160 ft/sec climb with 10-deg. ym at 80 ft and 94% rotor speed.

## AIRLINE OBSERVER

• **Negotiations are under way** for acquisition of four Canadian CL-44 turboprop cargo aircraft by Lufthansa. West German government is participating, as it once financed a major part of the purchase and lease the aircraft to Lufthansa. Canadian is also close to agreement with BOMB for two CL-44s, and a larger number later (AW June 18, p. 77). Major factor in the continuing orders for CL-44s is that the Canadian government is starting up its 80% of lower extended producers of the aircraft.

• **At least one foreign flag carrier is currently re-evaluating job requirements** of ticket agents. In addition to selling tickets, a complicated procedure by itself, agents of international carriers must be equipped to provide overseas travelers with information about political, economic and social conditions they will encounter in foreign countries.

• **Transport Workers Union settlement** with American Airlines centers on a new type of job security issue within the airline industry. TWU, which called off a threatened strike by 10,000 members after appointment of a presidential emergency board, claims that the airline has been substituting TWA fast service personnel for union employees at bus stations in at least five more cities and planned to spread this practice to more of the carrier's system. Mechanics feel this threatens their jobs. TWU members were still seeking the settlement last week.

• **Federal Aviation Agency this week will circulate within the government** a 755-page report containing a proposed implementation program for Project Rescue recommendations, to obtain both FAA and Defense Department consensus prior to public release. The report was prepared by FAA's systems design team (AW May 21, p. 48), headed by Albert Brown, after nearly a year's study. The plan, in accordance with original Rescue recommendations, does not propose to make widespread use of Super computers, which may draw more fire from the Air Force.

• **Industry proposals for an airline intelligence intervention system, a switching computer system to interconnect individual airline reservation computers** (AW Aug. 14, p. 45), were due late last week. Communications and in subject proposals to the Air Transport Assoc., include Collins Radio, Permutt-Packard, International Business Machines Corp., ITT Federal Laboratories, Radio Corp. of America, Raytheon Radar Division, and Teletype Corp.

• **ASEANA Chairman R. M. Ansett, will visit Britain, The Netherlands and U.S. to study turboprop transport markets.** Ansett currently is chiefly involved in the Boeing 737 and the BAC 111 and will also look at the Fokker F-27 small jet transport at a possible replacement for the Vietnam Vazcon. Under Australia's Airlines Re-equipment Act of 1978, the country's two airlines, Ansett and Trans Australia Airlines, cannot place orders for new aircraft before next November (AW Nov. 11, p. 46).

• **British Ministry of Aviation will tighten regulations covering strengthening of older aircraft, such as the Douglas DC-1, Hercules and the Viscount, which are operated by British independent air carriers.** Parliamentary Secretary Christopher Woolhouse recently said the move may involve "cosmetic penalties," and emphasized that the airplanes, although safe, do not measure up in all respects to International Civil Aviation Organization standards applied to all new aircraft produced since 1951. Particular stress will be placed on structural equipment and engine-out performance.

• **Key concerns among purchasers of the Boeing 727 over new reviews of the airplane's stability and controllability of the aircraft's wing flap and leading-edge flap arrangement.** Operation in substantial manner that is viewed as potential problem, although Boeing has included design and structural strength features specifically aimed at the flap thrust.

## SHORTLINES

• **Alaska Airlines reported a 59% increase in enroute transatlantic passengers during the first six months of the year.** Passengers totaled 15,135 June saw a record month, with 15,043 passengers representing a 59% increase over the same month last year. June load factor was 80%, compared with 69% in June, 1961.

• **Bozeman Air Lines credits a stepped-up advertising and promotion program for its 27.4% gain in revenue passenger miles during the past six months over the last half of 1961.**

• **British United Airways said it will inaugurate mail service across the Tasik Highway with its Victor VA 5 Hercules on July 23.** Round-trip fare will be \$1.39. Cargo during the eight-week period will be shared by BUA, Victoria Airways and British Petroleum.

• **Continental Airlines says its 29,273 passengers loadings in June represented a 11.4% increase over June, 1961, but 650 less than May's record high.**

• **Continental Air Lines has ordered its fifth Boeing 720B.** The airplane is slated for delivery in May, 1963.

• **Ethiopian Airlines has gained Spanish government approval to serve Madrid from Accra and Addis.** The new service is expected to begin this fall with Boeing 720B turboprop aircraft, making Madrid a gateway to the Middle East and East and West Africa.

• **Federal Aviation Agency, effective Jan. 15, granted Trans World Airlines a 2,200-hr. time between overhaul for the General Electric CT58-3-1 turboprop engine that powers TWA's Convair 580s.** This is highest allowable TBO to date for this engine in airline service.

• **Local service airlines reported a 17.5% increase in revenue passenger miles during the first six months of 1962, compared with the same period last year.** During June, traffic climbed 17% over June, 1961. Load factor for the month last half was 42.1%, compared with 41.4% in the same 1961 period. Load factor for June was 44.7%, slightly over the June, 1961, mark of 44.5%.

• **United Air Lines and 62.4% of its regular customers, in response to a recent questionnaire, indicated they agreed with UAL policy against the sale of liquor to jet cockpit accommodations.** Of the remainder, 12.8% took the opposite view and a 5% took no position.



## Look quick! That's TWA's new StarStream jet!

The dependable, fast-moving TWA StarStream® is the nation's newest transcontinental jet. Its four DynaFan® jet engines generate more power than any engines in use by any other airline flying across the U.S.A. In First Class you'll enjoy the new StarStream Royal Ambassador service, gourmet dining patterned on TWA's famous European service. Whether you fly First Class or thrifty Coach, you're always TWA's guest at mealtime.



\*DynaFans and DynaFan are service marks owned exclusively by Trans World Airlines, Inc.



**J 85**  
jet engine  
main frame  
by Kelsey-Hayes

The Northrop T-38... world's first supersonic trainer... is powered by two General Electric J 85 engines. The all-important main frame for the J 85 is produced by Kelsey-Hayes.

Stamped from Chromalloy, welded through electronic assistance and then subjected to Zylo, x-ray, magnetic and other special tests, this weldment is typical of the jet engine components that we produce in our huge Philadelphia plant. Here, we have the finest men, machines and experience to make any type of stamping or welding of supersonic jet engine components. Kelsey-Hayes Company, Front St. & Chestnut St., Philadelphia 30, Pa.

**KELSEY  
HAYES  
COMPANY**



ENGINEERING, MANUFACTURING, DESIGN, AND CONSTRUCTION  
Aircraft, Space and  
Land Vehicle Components  
Aircraft, Space and  
Land Vehicle Components  
Aircraft, Space and  
Land Vehicle Components

Aerospace Division and Agricultural Field  
Plant Tools for Industry and Home

## SAS Plan Offers Travel Agents Added Incentive of Trading Stamps

New York—Now market expansion programs involving trading stamps, designed to give private travel agencies a counterweight against the costs of large mail order firms into the tour business have been launched by Scandinavian Airlines System.

Grated as an incentive for travel agents, the program offers merchandise credits amounting to 1-1/2% more than the agent's standard 80% commission. SAS estimates that the program will generate between 1,500 and 2,000 new transatlantic tickets this year, with greater increases in 1963.

The scheme initiated the program in cooperation with the Gold Bond Stamp Co. of Minneapolis, and Minneapolis Amusement, Lewistown, Kan., one of the nation's largest gift agencies.

### European Tours

First European tours are offered, priced from \$512 to \$1,370 and ranging from 10 to 21 days duration. When an agent books one of the tours he receives a certificate equal to those stamp-filled Gold Bond books. The certificate, worth \$10 to \$12, can be redeemed from a selection of 2,800 merchandise items from the U.S. and 20 foreign nations. The larger the fare the stamp booklet, the more gift commodities the agent receives.

Although the program is a straightforward SAS sees it as one of the most practical market expansion efforts to arise at a time when the industry is pondering how to develop new business. "The main advantage is that it helps the private agent overcome the effects of the fare now being sold by the large mail order firms," says SAS spokesman and, referring to the business team being spearheaded by Steve Kerkbeck & Co. and Montgomery Ward.

SAS' role in the program is solely that of the transporting carrier. Gold Bond and Montgomery Ward's SAS 5-year exclusive on the arrangement through first-class rights. However, it is planned to offer the program to other carriers in the future.

Primary advantage to SAS is that the scheme increases the business in cruise for a very small investment of its own money. Expense of acquiring the tour and promotion is absorbed almost wholly by Montgomery and Gold Bond. The tour was down up to Minneapolis, which, in addition to being a standard tour agency, is also a "wholesaler." As a wholesaler, Minneapolis receives a commission in issuing transportation, accommodations and amenities for other agencies which book.

Gold Bond handles the tour promotion and awards gift certificates in the same form as it does to its regular agents.

SAS says the program will generate roughly double the more business than other stamp programs, in which persons accumulate their own stamp books until they have enough to pay for a tour. The scheme will reward stamp-distributing companies now approached with the program idea, but Gold Bond was the first to accept it.

To SAS when it is especially attractive to SAS when it is especially attractive to the market reached by advertising the tours," says SAS spokesman and "Gold Bond is making 15,000,000 mailings to individuals personally in the U.S. and Canada to familiarize travelers with the tour."

It is also being promoted through displays in the 210,000 retail outlets such as drugstores and supermarkets with Gold Bond and SAS. The 4,000 to 4,500 travel agencies in the U.S. have also been familiarized with the program through personal visits and mailings.

SAS feels the program will be open-

ally well received by smaller agencies which operate on a narrow profit margin.

"The prospect of obtaining something above the standard commission should give the extra effort an agent gets as they operate by a mail order firm," says SAS official and.

**Surveys Cited**  
Surveys cited by SAS indicate that even the small agencies must gross \$500,000 annually to justify agencies; with \$750,000 gross doubling twice the year had just. The survey shows that 55% of an agency's business must be volume to maintain these levels, SAS said.

"This will save each night into the agent's own bank," the SAS spokesman said. "It is his own money, and if it is distributed by the merchandise available through the gift certificates, that is all the more incentive for the agent to push these tours."

## UAL Doubts Small Jet Plane Need

New York—United Airlines is challenging the small short-haul jet transport but W. C. Munroe, United senior vice president of engineering and aircraft development, said United will have a need for an airplane of this class.

Member now in New York on the way to Europe to see the BAC 111 and its three-engine transport took delivery with Sed Aviation.

United's fleet expansion plan is complete through 1965, Munroe said, and his trip is not to be interpreted as an indication of United interest in any particular aircraft. United is also buying the Douglas Model 286, though Douglas will not proceed with the program without a reasonable number of orders.

The Boeing 727, of which United has ordered 40, will meet the airline's regional-haul requirements for an indefinite time, Munroe said. On short routes, such as New York-Washington, United has ordered the first order of the short-haul jet or VJSTOL aircraft will be more concerned from United's current expansion fairly.

"We're always interested in the Caravelle as a medium airplane, needed to fill the gap between the four-engine jet and the 727," Munroe said.

He said the planes, which cost United \$65 million, had each averaged 6.7% daily utilization during the year. This earned 754,000 passengers, from 9,111,000 to 10,000,000. Evaluation of the Caravelle, which has been 60% and as low as 50% on specific airports such as New York-Chicago.

United's 727s, with 99-passenger capacity in dual configuration, will be transported by the Caravelle, with 57 passengers at four-class seating, has not been met before with than Omaha

## New Viper provides reliable, low-cost power for executive jets



The Bristol Siddeley Viper 20 is now at an advanced stage of development for the next generation of light executive turbojets. This new version is basically a Viper 18 with a "zero" stage added to the compressor which gives a 30% increase in mass flow, a reduced turbine entry temperature and an improved specific fuel consumption. Like all its predecessors, the Viper 20 retains the basic design concepts of a simple, reliable engine with high thrust at high altitude and low fuel cost.



The Bristol Siddeley Viper 20

Delivering 3,000 lb thrust at take-off for a sea-level specific fuel consumption of 0.865 lb/lb/hr, the Viper 20 has potential for development to still higher thrusts and lower specific fuel consumptions.

### SELECTED FOR TWO NEW EXECUTIVE JETS

The Viper 20 has already been selected as the power unit for both the De Havilland 425 and the Pegasus/Douglas 808 "Voyager Jet" executive jet aircraft.

### PERFORMANCE

Operating from 1,600 to 3,000 ft thrust, the Viper series of turbojets has now been flying for over 8 years and has proved itself under a wide variety of atmospheric operational conditions. Over 1,000 engines have been ordered and Vipers currently power three aircraft types in service—Bristow Jet Provost, Mooney M8 305 and Jindivik target drone.

### BRISTOL SIDDELEY ENGINES LIMITED

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## Airline Traffic—May, 1962

|                         | Revenue<br>Passengers | Revenue<br>Passenger<br>Miles<br>(RPM) | Passenger<br>Load<br>Factor<br>% | U. S. Mail<br>Tons-Miles | Baggage<br>Tons-Miles | Freight<br>Tons-Miles | Total<br>Revenue<br>Tons-Miles | Over-all<br>Revenue<br>Load Factor<br>% |
|-------------------------|-----------------------|--|----------------------------------|--------------------------|-----------------------|-----------------------|--------------------------------|---|
| <b>DOMESTIC TRUNKS</b>  |                       |  |                                  |                          |                       |                       |                                |   |
| American                | 691,393               | 545,811                                | 80.8                             | 2,772,115                | 1,364,261             | 12,165,542            | 16,299,918                     | 82.6                                    |
| Boeing                  | 386,476               | 312,777                                | 80.7                             | 472,499                  | 707,584               | 1,955,341             | 3,135,424                      | 80.7                                    |
| Continental             | 382,728               | 297,881                                | 77.9                             | 363,451                  | 117,528               | 1,957,544             | 3,138,524                      | 77.9                                    |
| Delta                   | 336,010               | 307,364                                | 91.7                             | 708,471                  | 438,568               | 3,149,812             | 4,296,851                      | 91.7                                    |
| Eastern                 | 730,471               | 597,715                                | 81.8                             | 1,754,138                | 633,074               | 3,138,129             | 5,525,341                      | 81.8                                    |
| Norfolk                 | 126,178               | 125,125                                | 99.1                             | 102,267                  | 1,073,977             | 12,381,397            | 13,557,641                     | 99.1                                    |
| Northwest               | 174,858               | 148,245                                | 84.8                             | 159,241                  | 24,170                | 211,656               | 3,764,127                      | 84.8                                    |
| Northwest               | 161,170               | 134,586                                | 83.5                             | 714,455                  | 197,199               | 1,957,544             | 3,669,199                      | 83.5                                    |
| Trans World             | 484,477               | 323,721                                | 66.8                             | 1,840,800                | 726,614               | 3,308,706             | 5,876,121                      | 66.8                                    |
| United                  | 691,393               | 607,624                                | 88.1                             | 4,326,076                | 1,429,147             | 16,771,389            | 22,526,612                     | 88.1                                    |
| Western                 | 144,314               | 56,453                                 | 39.1                             | 556,498                  | 136,277               | 111,912               | 16,763,386                     | 39.1                                    |
| <b>INTERNATIONAL</b>    |                       |  |                                  |                          |                       |                       |                                |   |
| American                | 8,343                 | 6,473                                  | 77.5                             | 7,309                    | 528                   | 122,343               | 1,171,674                      | 77.5                                    |
| Boeing                  | 7,714                 | 11,100                                 | 144.2                            | 6,614                    | 317,454               | 1,171,674             | 1,895,442                      | 144.2                                   |
| Continental             | 42,778                | 2,263                                  | 5.3                              | 2,442                    | 10,100                | 202,375               | 214,917                        | 5.3                                     |
| Delta                   | 1,244                 | 2,531                                  | 20.3                             | 4                        | 20,344                | 263,100               | 283,448                        | 20.3                                    |
| Eastern                 | 44,776                | 44,176                                 | 98.5                             | 1,377,119                | 8,449                 | 899,419               | 8,116,146                      | 98.5                                    |
| Norfolk                 | 8,320                 | 1,271                                  | 15.3                             | 1                        | 5,051                 | 166,457               | 171,529                        | 15.3                                    |
| Northwest               | 23,477                | 44,158                                 | 18.8                             | 1,923,339                | 3,473                 | 974,130               | 2,797,468                      | 18.8                                    |
| Trans World             | 6,341                 | 4,128                                  | 65.0                             | 46,222                   | 3,024                 | 312,052               | 361,298                        | 65.0                                    |
| United                  | 113,742               | 348,811                                | 30.7                             | 3,054,813                | 6,666,270             | 28,320,352            | 38,031,435                     | 30.7                                    |
| Western                 | 93,479                | 197,528                                | 21.2                             | 545,454                  | 7,619                 | 4,117,690             | 4,770,763                      | 21.2                                    |
| Boeing                  | 12,344                | 188,770                                | 15.3                             | 4,345,755                | 36,108                | 306,347               | 4,728,210                      | 15.3                                    |
| Delta                   | 10,124                | 19,479                                 | 19.2                             | 88,767                   | 658,739               | 2,682,454             | 3,429,960                      | 19.2                                    |
| Northwest               | 115                   | 547                                    | 4.8                              | 2,715                    | 1,837                 | 5,697                 | 8,249                          | 4.8                                     |
| Trans World             | 11,882                | 18,113                                 | 15.3                             | 46,222                   | 3,024                 | 312,052               | 361,298                        | 15.3                                    |
| United                  | 20,127                | 105,148                                | 5.2                              | 3,272,941                | 2,617,267             | 13,533,340            | 19,423,548                     | 5.2                                     |
| Western                 | 14,458                | 24,199                                 | 16.7                             | 397,340                  | 11,410                | 216,294               | 4,666,714                      | 16.7                                    |
| Boeing                  | 7,943                 | 16,158                                 | 20.3                             | 14,244                   | 54,919                | 1,161,939             | 1,231,101                      | 20.3                                    |
| <b>LOCAL SERVICE</b>    |                       |  |                                  |                          |                       |                       |                                |   |
| American                | 18,765                | 14,811                                 | 79.0                             | 16,375                   | 47,489                | 706,739               | 1,194,603                      | 79.0                                    |
| Boeing                  | 36,219                | 1,728                                  | 4.8                              | 6,523                    | 12,853                | 107,893               | 127,274                        | 4.8                                     |
| Continental             | 21,612                | 4,263                                  | 19.7                             | 17,073                   | 1,000                 | 100,100               | 118,173                        | 19.7                                    |
| Delta                   | 19,389                | 7,744                                  | 40.0                             | 25,145                   | 19,449                | 79,841                | 114,435                        | 40.0                                    |
| Eastern                 | 20,770                | 4,201                                  | 20.2                             | 11,816                   | 31,617                | 100,100               | 142,533                        | 20.2                                    |
| Norfolk                 | 19,424                | 14,114                                 | 72.7                             | 26,173                   | 31,128                | 1,134,128             | 1,191,429                      | 72.7                                    |
| Northwest               | 69,710                | 14,471                                 | 20.6                             | 86,532                   | 14,128                | 79,180                | 1,633,804                      | 20.6                                    |
| United                  | 27,120                | 10,407                                 | 38.4                             | 16,164                   | 16,164                | 1,134,128             | 1,191,429                      | 38.4                                    |
| Western                 | 48,127                | 7,003                                  | 14.6                             | 13,732                   | 2,260                 | 12,771                | 162,871                        | 14.6                                    |
| Boeing                  | 19,449                | 10,404                                 | 53.5                             | 17,341                   | 17,341                | 20,211                | 1,913,128                      | 53.5                                    |
| Continental             | 7,217                 | 2,225                                  | 30.8                             | 16,164                   | 16,164                | 1,134,128             | 1,191,429                      | 30.8                                    |
| Delta                   | 23,027                | 7,714                                  | 33.5                             | 25,440                   | 13,129                | 46,339                | 85,935                         | 33.5                                    |
| Western                 | 34,142                | 6,431                                  | 18.8                             | 16,112                   | 2,414                 | 27,079                | 854,251                        | 18.8                                    |
| <b>ALASKA LINES</b>     |                       |  |                                  |                          |                       |                       |                                |   |
| Alaska                  | 39,367                | 6,231                                  | 15.8                             | 4,147                    | 3,719                 | 107,100               | 115,166                        | 15.8                                    |
| Boeing                  | 34,751                | 5,267                                  | 15.2                             | 4,002                    | 3,719                 | 107,100               | 115,166                        | 15.2                                    |
| <b>CANADIAN LINES</b>   |                       |  |                                  |                          |                       |                       |                                |   |
| American                | 1,420                 | 1,420                                  | 100.0                            | 34,276                   | 34,276                | 1,420                 | 1,420                          | 100.0                                   |
| Boeing                  | 1,420                 | 1,420                                  | 100.0                            | 34,276                   | 34,276                | 1,420                 | 1,420                          | 100.0                                   |
| Continental             | 1,420                 | 1,420                                  | 100.0                            | 34,276                   | 34,276                | 1,420                 | 1,420                          | 100.0                                   |
| Delta                   | 1,420                 | 1,420                                  | 100.0                            | 34,276                   | 34,276                | 1,420                 | 1,420                          | 100.0                                   |
| Eastern                 | 1,420                 | 1,420                                  | 100.0                            | 34,276                   | 34,276                | 1,420                 | 1,420                          | 100.0                                   |
| Northwest               | 1,420                 | 1,420                                  | 100.0                            | 34,276                   | 34,276                | 1,420                 | 1,420                          | 100.0                                   |
| United                  | 1,420                 | 1,420                                  | 100.0                            | 34,276                   | 34,276                | 1,420                 | 1,420                          | 100.0                                   |
| Western                 | 1,420                 | 1,420                                  | 100.0                            | 34,276                   | 34,276                | 1,420                 | 1,420                          | 100.0                                   |
| <b>HELICOPTER LINES</b> |                       |  |                                  |                          |                       |                       |                                |   |
| Boeing                  | 7,710                 | 168                                    | 21.9                             | 272                      | 272                   | 1,134                 | 1,680                          | 21.9                                    |
| Continental             | 1,467                 | 2,017                                  | 13.8                             | 1,701                    | 1,701                 | 2,017                 | 3,718                          | 13.8                                    |
| Delta                   | 14,551                | 145                                    | 1.0                              | 145                      | 145                   | 145                   | 145                            | 1.0                                     |
| <b>ALASKA LINES</b>     |                       |  |                                  |                          |                       |                       |                                |   |
| Alaska Airlines         | 9,308                 | 7,445                                  | 80.0                             | 64,296                   | 1,495                 | 1,134,128             | 3,837,619                      | 80.0                                    |
| Boeing                  | 11,187                | 107                                    | 0.9                              | 6,431                    | 16,164                | 1,134,128             | 1,312,721                      | 0.9                                     |
| Continental             | 2,167                 | 207                                    | 9.5                              | 3,774                    | 48,111                | 1,134,128             | 1,680,919                      | 9.5                                     |
| Delta                   | 4,119                 | 47                                     | 1.1                              | 743                      | 8,449                 | 1,134,128             | 1,223,320                      | 1.1                                     |
| Northwest               | 2,784                 | 716                                    | 25.7                             | 4,128                    | 60,829                | 1,134,128             | 1,805,671                      | 25.7                                    |
| United                  | 14,167                | 15,000                                 | 106.0                            | 164,710                  | 8,127                 | 203,343               | 223,473                        | 106.0                                   |
| Western                 | 1,371                 | 311                                    | 22.7                             | 26,173                   | 21,171                | 217,107               | 264,651                        | 22.7                                    |
| Boeing                  | 722                   | 24                                     | 3.3                              | 819                      | 2,441                 | 6,431                 | 9,705                          | 3.3                                     |
| Continental             | 14,167                | 15,000                                 | 106.0                            | 164,710                  | 8,127                 | 203,343               | 223,473                        | 106.0                                   |
| Delta                   | 1,371                 | 311                                    | 22.7                             | 26,173                   | 21,171                | 217,107               | 264,651                        | 22.7                                    |
| Northwest               | 2,784                 | 716                                    | 25.7                             | 4,128                    | 60,829                | 1,134,128             | 1,805,671                      | 25.7                                    |
| United                  | 14,167                | 15,000                                 | 106.0                            | 164,710                  | 8,127                 | 203,343               | 223,473                        | 106.0                                   |
| Western                 | 1,371                 | 311                                    | 22.7                             | 26,173                   | 21,171                | 217,107               | 264,651                        | 22.7                                    |

Compiled by KIRKIN WEEK from airline reports to the Civil Aeronautics Board.



TWO-MAN lunar excursion vehicle is seen in the escape mode (left) between the S-4B third stage of the Saturn C-5 booster and the Apollo spacecraft with its service module. Although the model shows two jets firing in the "bay," they would not need it until ready to descend to the lunar surface. At right is a model of the Apollo spacecraft with its service module behind it.

## Lunar Orbital Rendezvous Poses Biggest

By David H. Hoffman

Washington — Technical challenge posed by lunar orbit rendezvous dwarfs the already significant advancements of the U.S. in manned space flight.

Decisions to employ the technique for Project Apollo (AW July 8, p. 21), means that the safe return of the first U.S. astronauts to explore the lunar surface will hinge on the precise execution of a rendezvous maneuver 240,000 mi from earth.

The Gemini program, envisioned until now by the pioneering Mercury flights and the preparations for Apollo, now assumes an even greater importance. In the long-duration Gemini flights, the spacecraft's two-man crew will attempt the first rendezvous of the U.S. space program in a circular, 150 mi high orbit at the earth.

Interplay of the mission or a best explained in terms of the tolerances within which the plans must work. During the first phase of docking, as the capsule is closing with its target at a rate of 1.5 ft/sec, one foot of uncontrolled lateral displacement will spoil the attempt. Sensing maneuvers probably will apply to rendezvous in lunar orbit.

In a continuous vote, National Aeronautics and Space Administration's

space and Space Administration's own space council decided to concentrate priority on the lunar orbit rendezvous approach. An orbit that highly sensitive decrease in lunar orbit altitude necessary to the lunar mission could have been avoided following studies conducted by Marshall Space Flight Center. Reconnaissance made by the Galileo Committee on large launch vehicle planning marked this direction.

A few months ago, however, Marshall reversed itself and endorsed lunar orbit rendezvous—the technique that was favored by NASA's Manned Spacecraft Center in Houston.

### Flexible Approach

NASA is careful to point out that its capsule system will change before the first Apollo mission, and that even its lunar orbit rendezvous scheme may be changed. Nevertheless, as it is now defined, the U.S. manned lunar landing program will follow this pattern:

Launch vehicle will be a single Saturn C-5, with a Boeing S-4C booster stage powered by six Rocketdyne F-1 engines developing a total of 7.5 million lb thrust. Its second or S-2 stage, built by North American, will house a cluster of five hydrogen-oxygen fueled Rocket-

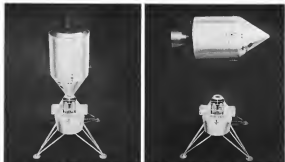
dye J-2 engines, each developing 370,000 lb thrust. The Douglas S-4B third stage will incorporate a single J-2 engine.

The entire vehicle and Apollo spacecraft will be assembled in a virtual assembly building at Cape Canaveral. Design criteria for this structure will have been developed by NASA by this fall. After assembly and systems checkout, the entire vehicle will be mated to its launch complex by a rubber-weathered, crawler-type transportation loader, which NASA has decided is superior to large or rail transportation systems for this purpose.

In using the virtually assembly building and the crawler, NASA hopes the three Saturn vehicles must spend on the pad prior to launch will not be more than several months to a week at most. As a result, launching schedules which now exist allow for possible engine test windows, will gain some flexibility.

Stranding vertically on its pad, the fully-docked C-5 will be 125 ft tall and weigh about 5 million lb. The overall spacecraft, tipped by an escape tower very similar to those employed in Mercury flights, will consist of these units:

• **Command module**, weighing about two tons and 17 ft high, will house the Apollo crew during lift-off and the trans-lunar phase of the mission. It will have



AFTER SEPARATION of the Apollo command and service modules from the S-4B, the command unit will execute a two-point, zero-zero (0/0) and mate to the lunar excursion craft. The three-component Apollo vehicle—command module, service module and S-4B stage—will separate from the S-4B and fly on to lunar orbit. In lunar orbit, two astronauts will enter the bag through an air lock.

## Technical Challenge to NASA

a 154-in. base diameter and a 33 deg side wall slope.

• **Service module**, weighing 29 tons and 35 ft high, will contain the propellant for mid-course corrections and earth return. Diameter also will be 114 in. Propulsion system probably will incorporate limited engine-out capability.

• **Lunar excursion module**, weighing about 15 tons and 20 ft tall, will carry two astronauts to and from the lunar surface. It will be mated directly, before Apollo propellant is a system independent from that of the service module.

North America's Space and Information Systems Division is contractor for the command and service modules. Design of the excursion module will be defined during the next three months by industry proposals submitted by NASA.

An ideal launch will result in total burn of the S-4C and S-2 stages and a partial burn of the S-4B upper stage. This sequence will establish the S-4B and the three modules of the spacecraft in an earth-orbiting trajectory. After at least one half revolution, during which the crew and Apollo controllers on earth will decide whether to undertake trans-lunar flight, the spacecraft will approach its lunar window.

Once a decision is reached, negoti-

tion of the S-4B engines will give the spacecraft a nominal escape velocity of 15,000 mph. Total spacecraft weight at that point is predicted to be about 85,000 lb. Even if that increases slightly, as is expected, C-5 has no engine capacity of about 90,000 lb, thus affording some design latitude.

When the spacecraft is on its trans-lunar trajectory, the lunar excursion module, still located in the upper section of the S-4B, is mated by the command service module immediately by one of two techniques. The method now preferred by NASA involves total separation of the command service module from the S-4B stage and their re-orientation in space.

During this maneuver, the S-4B flaps that enclose the bag would close. The command/service module examination, its critical end now pointing back toward earth, would mate with the exposed bag. When the attachment was complete, the empty S-4B stage would be jettisoned, leaving the service module's propulsion system for use in possible orbits. Thereafter, the bag would form the upper module of the spacecraft.

An alternative technique would utilize a subcircular orbit attached to the service module to extend the bag from



BAV-8 looking glass assembly will be used in launching pad the second from the lower section to the orbiting spacecraft. Though not underway photo, assembly is the bag will maintain voice and radio contact.



**SERVICE MODULE** will contain, in addition to various spacecraft systems such as the fuel cells, the propellant and engine for return flight and attitude correction, it will be piloted prior to earth reentry. Typical mission will consume 7 days—5 days en route, 1 in lunar exploration and 1.5 in the return flight to earth.

the 5-60 days and position it on top of the spacecraft (AW July 2, p. 82).

During the en route phase of the mission, the Apollo crew would maintain its system checkout. To accomplish end mission objectives, the astronauts would rely primarily on the command module's guidance system and entirely on the service module's propulsion system.

#### Velocity Goals

At an appropriate point in space, roll another burn at the service module's engines would give the entire spacecraft a 1,000 f.p.s. velocity gain, dropping it into lunar orbit. Its velocity at orbit would be about 5,800 f.p.s. The orbit itself would approximate a loop— $\pm 10$  deg in latitude from the lunar equator. It would be circular and have an altitude of about 100 mi.

Dr. Joseph F. Shea, deputy director of research in NASA's Office of Manned Space Flight, offered this description of the last step.

"After determining that all the subsystems are working and that we are ready to commit to the mission, two of the three astronauts will transfer from the command module to the lunar excursion module. Once they are transferred, we will then, using the propellant stored in the lunar excursion module, put the excursion module in a trajectory which has the same period as the circular orbit of the command module—service module combination, but has a much lower perigee, a perigee of approximately 8,000 ft. This will enable us to go down and in orbit around the moon, an altitude of something like 10 mi, the extended launch (and landing) site."

Elaborated orbital insertion by the bag would have an aspect of several hundred miles. Its actual period, as well as that of the spacecraft, would be about 2 hr. Days' thrust-to-weight ratio would be about 1 to 7.

If the two astronauts in the bag decided to land, a second burn of the module's engines would bring them down to a low position above the moon's surface. This bag's landing gear stowed in a launch position along its side, would then be extended.

From the bag's plan down, the track down point on the lunar surface can be selected by the astronaut. Up to 1 mi. can be spent hovering while the area around the excursion module is re-scanned visually.

In addition, the bag can be translated as much as 1,000 ft. in any direction while in hover.

For the rendezvous phase of the mission, the bag's heading gear and the homing for its inertial data would be selected as a launch and then stored on the lunar surface.

Around from the apogee must begin during a 6-7 min. window, which probably would occur every two hours. When the rendezvous spacecraft was still about 1 day away from a point directly over the landing/launching site, the bag's engine would be ignited and the bag launched on an intercept trajectory. Expected return flight surface to the astronauts, how the lunar surface would be plotted by the spacecraft's passive aid.

This was up the ascent trajectory, plotted in the bag would clearly a well-known encounter. Final docking phase would begin when the bag was 3-6 mi

from the mother spacecraft, a distance that could be calculated by radar or optical observations. When the vehicle and plane of the spacecraft's orbit were duplicated by the bag, the bag would be oriented and stored as an orbit on the command module.

The two astronauts in board the bag would enter the command module through the lock and the bag would be retrieved as the lunar orbit. Service module's propulsion system, with more than 20,000 lb. thrust remaining, would lock the spacecraft onto its return trajectory.

#### Re-entry Procedure

Prior to re-entry, the service module would be jettisoned and the command module's winging between 5,500 and 10,000 ft., pitched in its 40-45 mile re-entry corridor. Angle of attack during re-entry would be about 30 deg. When maximum pressure and deceleration are experienced, no propulsion would be needed except for attitude control. NASA also is hopeful that by the first Apollo flight, it will be able to return capsule communication throughout the re-entry phase.

Lifting ratio of the command module is designed to be about 0.5 at supersonic speeds and about 0.7 at subsonic speeds. Gamma control, by contrast, has a compressible ratio of about 0.25 while the Mercury capsule's ratio is approximately 0.5.

In exploiting such the inherent lift through attitude control during the re-entry, Apollo pilots should be able to land within a 4-degree  $\pm 10$  in. square. Final braking of the capsule may be provided by three 8 ft. parachutes,

unless the Gemini program proves that a parachute of Apollo size is feasible. With the normal mode possible by such landing aids, NASA hopes the command module can be landed within six miles of the site of a large report. Several much larger sites in U.S. plans have been considered by the space agency, when a landing site with generally good visibility and low of the atmospheric pool by a dense population.

At this early stage of how the rendezvous planning, there is a possibility that the C-7's third step and the spacecraft it carries will have to describe in many in 15 earth orbit while waiting for the lunar window. If this proves true, the Apollo crew probably can complete a preliminary checkout of command and excursion module systems before commencing themselves in the 72 hr. lunar stay. Otherwise, system checkout would take place on route to the moon.

**Control From Earth**  
As a further safeguard, NASA expects that its deep space communications facility (DSF), which then will consist of three stations, complex located about 130 deg. apart on the earth's surface, will be able to plot the command-service module's lunar orbit with precision. This means that should the entire lunar orbit system, with the exception of its final docking phase, could be communicated from stations on earth.

#### About Possibilities

Counting down can be initiated during almost any phase of the mission, even after acquisition of the 5-60 deg. gain after the spacecraft escape velocity. For example, should a critical system malfunction during the lunar phase, return to earth could be accomplished in either of two ways.

• **Returning to the moon** as a long coast and then using lunar gravity to slow and turn the spacecraft back toward earth. The spacecraft then would use the command module's guidance system and the service module's propulsion system to return. Effect of lunar gravity would be calculated and used by NASA's deep space communications network. As in a normal mission, only the command module would re-enter the earth's atmosphere. This is the most probable method.

• **Use more short techniques**, which would entail scoring some short of the moon's gravitational field.

Because the bag's elliptical orbit is to have the same lunar period as the circular orbit of the mother spacecraft, the two should pass close together once per revolution. Should an abort prove necessary after the bag has disengaged, the coupling of the two orbit paths offers a natural opportunity for re-encounters.

According to Shea, the two astronauts will be so constrained that at all times during the bag's re-entry, hover, translation and touchdown on the lunar surface, the astronaut in the command-service module combination will maintain line-of-sight communication with the two astronauts on board the bag. Two-way radio contact also will be continuous during these critical maneuvers. As a result, Shea said, "it's very simple matter of inspection" will enable

the bag to abort and rendezvous with the overhead spacecraft at any point prior to touchdown.

In addition, the author's spacecraft would carry redundant guidance and wrong systems that would enable it to "climb" as a "bouncer" the bag and other rendezvous of necessity. Thus, the actual rendezvous could be conducted either from the bag or by the single station at the controls of the orbiting spacecraft.

#### Control From Earth

As a further safeguard, NASA expects that its deep space communications facility (DSF), which then will consist of three stations, complex located about 130 deg. apart on the earth's surface, will be able to plot the command-service module's lunar orbit with precision. This means that should the entire lunar orbit system, with the exception of its final docking phase, could be communicated from stations on earth.

Similarly, the bag's orbital (elliptical) orbit would be monitored from the deep space net.

Life-supporting equipment and supplies probably will be positioned on the lunar surface prior to the astronauts' arrival. Before the space agency decides to develop the unmanned lunar logistics vehicle that would carry such things to a point near an intended landing site, it may it will emphasize a test to night search study of the entire area. But since Shea says the study will only involve an earlier decision.

It would be relatively simple, NASA officials have said, to adapt the logistics vehicle to the command lunar exploration mission, assuming that the 1960s program. Even though Congress

deferred almost all funding for Progress from NASA's Fiscal 1961 budget, it is expected to approve funds for the logistics vehicle if they are requested by the space agency.

Policy NASA will attach to this program is reflected in the commitment at its initial efforts.

"It would appear," NASA Administrator James E. Webb said recently, "that if we go forward with a basic command vehicle, a logistic support vehicle would be very important to use in conjunction with it. It would also appear that this might be equated into a check-out vehicle."

"We expect to do the work very soon," Webb said, "because this means a big development of unmanned lunar landing equipment, which is quite an undertaking."

D. Bennett Helms, director of NASA's Office of Manned Space Flight, said that if the mission is approved, the two astronauts would be lost unless they could return to a logistics vehicle waiting on the moon's surface.

#### Lunar Exploration

Using such equipment stored by the command spacecraft, the astronauts could spend up to four days exploring the moon's surface, although risk. Apollo missions will be programmed for times of only 24 hr. or less. Nevertheless, through development of a direct ascent logistics vehicle, NASA could provide the technology of performing and long-term support missions on the moon. While some astronauts, mooned planetary landings are undertaken in the future, mission success may hang on the pre-positioning of such supplies.

NASA's vehicles development, the vehicle dated to launch the first leg.



**COMMAND MODULE** will weigh 5,500 to 7,000 lb. at reentry. That offset, it must penetrate the earth's atmosphere within a corridor 40 mi. wide. During descent, crew will maneuver the capsule toward a land recovery area about 10 mi. square. Ejector seats parachute in a 4-degree  $\pm 10$  in. square. Ejector seats will be employed to locate the landers.

top package will be the Saturn C-1B, which can land up to 2,000 lb. on the lunar surface. Later missions will utilize use of C-2, which can place a 27,000-lb. package on the moon in one mission.

Applying rendezvous techniques proposed in the Gemini program, testing of Apollo's rendezvous-capable moon module construction will begin about 1967. Again, NASA will utilize the C-1B vehicle, which can reject three modules, unfueled, into an earth orbit without using external (retro) periods of its lifting capability. Still on the study is how much fuel can be carried by the bag and service modules to permit rendezvous practice in earth orbit.

At this point, NASA's thinking calls for inspection of all three modules into earth orbit during tests. Several rendezvous operations will follow such successful missions. During the first of these, however, NASA probably will allow astronauts to enter the bag and disengage it from the other two modules.

#### Command Module

Initially, only module will be controlled from the command module, as it could be during its reentry. Later in the program-NASA has not yet decided how many test flights will be necessary-outstations will be controlled to the bag. It adds, in time, will be shown to be as much as 50 lb. before rendezvous is attempted, both from the command module and the bag.

"It is our intention," Shum said, "to exercise completely the rendezvous maneuver in the same manner in which it will be performed in the vicinity of the Moon. Otherwise, the self-insulating the bag out to the limit of its separation loss, plus giving it a variety of rejection and displacements relative to the spacecraft."

Feasibility of connecting the bag and the spacecraft by cable during the first few rendezvous operations has been discussed and tentatively discarded by NASA.

After studying for the better part of a year the three competitive techniques for manned lunar landing, NASA now has chosen a based on three assumptions:

- Lunar orbit rendezvous would land men on the moon about 20 months earlier than direct ascent, or as to 15 months earlier than earth orbit rendezvous. Although it would cost 18 to 15% less than either of these two modes, that does not mean that Apollo would be a 30 to 45% saving to the overall cost of the Apollo program, which will involve spending \$16 to \$18 billion.

- Earth orbit rendezvous, particularly because it would require less than C-2's instead of one, would have only half the probability of mission success

#### Apollo Redoubt

North American Aviation's Space and Information Systems Division is evaluating various mission studies for Apollo's every mission of about \$100 million. Rules under proposed for Apollo is a limited one with a direct lift and leaving a lander at about 15,000 ft. and height of about 2 to 3,000 ft. at the end of the Apollo test, which, in a region of repeated loss, the volume will prevent difficult maneuvering problems, such as suspension required to develop in those time-limited configurations on the earth Apollo vehicle, the thermal conductivity of the vehicle material, and its conductivity.

at does the lunar surface. It also would require landing and developing a tanker version of the C-1 plus a 50-ton gas of fueling and 1,000-lb. payload, which are expected to be added to, only on the lunar surface.

- Direct ascent would require development of the Nova booster, as well as the landing and takeoff module, as a single-stage vehicle. As a result, NASA's landing module probably would be built during the mid-1960s, when other personal demands proposed by the Apollo program will be at a high level. However, Nova development would proceed to a vehicle such as payload capability about 60% greater than that of C-2. C-3, by comparison, will be able to launch 10 tons the weight of the earlier C-1 Saturn.

It follows that NASA will start Nova development for at least two years, perhaps development of the lunar landing and takeoff module, which will be the first stage, and a second stage, up to three times the lifting capability of C-2. Meanwhile, General Dynamics and Chrysler-Mercury are to be awarded a job, NASA adds, "predevelopment study contract worth about \$1 million, to help define the advanced Nova's configuration. Studies will cover a period of about eight months."

#### Facilities

Division to go loan-out, rather than earth orbit with training, will give the Lunar Operations Center more time to finish construction of the new Saturn C-2 launch stands at Cape Canaveral, Fla. Two stands will be adequate for the initial lunar landing attempt, since only two launch vehicles probably will be involved—one for the habitable carrier and one for the lunar lander, possibly. Launch of the lander out will provide the manned vehicle by several days to weeks, so that a back-up manned vehicle can be mounted on the second stand at right time.

Earthward approach will be for the stands—two for the tank, two for

second vehicle and one backup for the other tank or second craft—with two other tanks initially and the other two following close behind on a tight set of trajectories selected. Now, with the acquisition of launching two C-2s side within a day of each other, the first two stands will be built with depth of the tank and fourth month by the 15th of November.

Lunar Operations Center presently is studying the modifications of building assembly lines in the Vertical Assembly Building (AVB) July 1, p. 115) two at a time. Eventually the building will have no bars. Because of doubts about the wisdom of putting in the massive foundations required for the 400-ft.-ft. tall structure, a pre-mold beam and the possible alternative of construction might have on process proceeding in separate bays. NASA is inclined to build the first bay between two main bays and then build the two main bays, which are expected to be added to the five bay between larger main bays will be substituted in the third stage of Saturn C-2 instead of the S-4B, will be built first.

Large crane personnel emphasize that facilities being built at Cape Canaveral will be used for more than the lunar landing system and that the decision to use the lunar-orbit technique will be made only after it is clear that the work assigned to the center.

Dromen also has been made by NASA to use the crawler system of transporters (see July 1, p. 115) and the crawler system of the Apollo modules as to be assembled and divided out at Cape Canaveral. The crawler consists of two separate paths, one which when actual construction is under way, and a second path, beneath the table which will move the Saturn Apollo vehicle from the assembly area to the launch stand. After assembly of the launch vehicle and the vehicles in the Vertical Assembly Building the crawler will move 30-in.-dia. portable axes to clear the table from the ground and then drive the main unit out to a launch stand under two miles distant. One property positioned on the stand, the axes will be lowered, the table (on the Saturn Apollo vehicle) moved up at until and the launch Saturn-Apollo driven into the launch stand.

Digital computer system will be built into the table to check any obstacle of the three launch stands and three space craft component and will be the present, plus of the crawler equipment during the mobile launch. One of the two major digital computers in the launch control center will receive remote control of the vehicle axis system from the Saturn-Apollo building and will respond to data provided by the computer in the table's house.

## NASA Reports Top Industry Contractors

National Aeronautics and Space Administration has announced the 100 contractors receiving the highest net value direct awards from NASA during the period July 1, 1963 to Dec. 31, 1963. Of direct awards of \$23,800, or more, \$105 awards in 45% were placed in areas classified as degraded.

The 100 top contractors included:

|  | Contract Value \$ | Total % |
|--|-------------------|---------|
| 1 North American Aviation Co., Torrance, Calif.    | \$10,419,116      | 11.6    |
| 2 McDonnell Aircraft Corp., St. Louis, Mo.         | 4,718,100         | 1.4     |
| 3 Douglas Aircraft Co., Inc., Santa Monica, Calif. | 3,718,100         | 11.9    |
| 4 Lockheed Aircraft Corp., Burbank, Calif.         | 3,118,100         | 8.8     |
| 5 Boeing Aircraft Co., Everett, Wash.              | 2,718,100         | 11.8    |
| 6 General Dynamics Corp., Fort Worth, Texas        | 2,118,100         | 11.9    |
| 7 North American Aviation Co., Torrance, Calif.    | 1,718,100         | 11.8    |
| 8 Boeing Aircraft Co., Everett, Wash.              | 1,318,100         | 11.8    |
| 9 Lockheed Aircraft Corp., Burbank, Calif.         | 1,118,100         | 11.8    |
| 10 North American Aviation Co., Torrance, Calif.   | 1,018,100         | 11.8    |
| 11 Boeing Aircraft Co., Everett, Wash.             | 918,100           | 11.8    |
| 12 Lockheed Aircraft Corp., Burbank, Calif.        | 818,100           | 11.8    |
| 13 North American Aviation Co., Torrance, Calif.   | 718,100           | 11.8    |
| 14 Boeing Aircraft Co., Everett, Wash.             | 618,100           | 11.8    |
| 15 Lockheed Aircraft Corp., Burbank, Calif.        | 518,100           | 11.8    |
| 16 North American Aviation Co., Torrance, Calif.   | 418,100           | 11.8    |
| 17 Boeing Aircraft Co., Everett, Wash.             | 318,100           | 11.8    |
| 18 Lockheed Aircraft Corp., Burbank, Calif.        | 218,100           | 11.8    |
| 19 North American Aviation Co., Torrance, Calif.   | 118,100           | 11.8    |
| 20 Boeing Aircraft Co., Everett, Wash.             | 108,100           | 11.8    |
| 21 Lockheed Aircraft Corp., Burbank, Calif.        | 98,100            | 11.8    |
| 22 North American Aviation Co., Torrance, Calif.   | 88,100            | 11.8    |
| 23 Boeing Aircraft Co., Everett, Wash.             | 78,100            | 11.8    |
| 24 Lockheed Aircraft Corp., Burbank, Calif.        | 68,100            | 11.8    |
| 25 North American Aviation Co., Torrance, Calif.   | 58,100            | 11.8    |
| 26 Boeing Aircraft Co., Everett, Wash.             | 48,100            | 11.8    |
| 27 Lockheed Aircraft Corp., Burbank, Calif.        | 38,100            | 11.8    |
| 28 North American Aviation Co., Torrance, Calif.   | 28,100            | 11.8    |
| 29 Boeing Aircraft Co., Everett, Wash.             | 18,100            | 11.8    |
| 30 Lockheed Aircraft Corp., Burbank, Calif.        | 8,100             | 11.8    |

|   |         |     |
|---|---------|-----|
| 31 North American Aviation Co., Torrance, Calif.  | 1,488   | 1.4 |
| 32 Boeing Aircraft Co., Everett, Wash.            | 1,388   | 1.4 |
| 33 Lockheed Aircraft Corp., Burbank, Calif.       | 1,288   | 1.4 |
| 34 North American Aviation Co., Torrance, Calif.  | 1,188   | 1.4 |
| 35 Boeing Aircraft Co., Everett, Wash.            | 1,088   | 1.4 |
| 36 Lockheed Aircraft Corp., Burbank, Calif.       | 988     | 1.4 |
| 37 North American Aviation Co., Torrance, Calif.  | 888     | 1.4 |
| 38 Boeing Aircraft Co., Everett, Wash.            | 788     | 1.4 |
| 39 Lockheed Aircraft Corp., Burbank, Calif.       | 688     | 1.4 |
| 40 North American Aviation Co., Torrance, Calif.  | 588     | 1.4 |
| 41 Boeing Aircraft Co., Everett, Wash.            | 488     | 1.4 |
| 42 Lockheed Aircraft Corp., Burbank, Calif.       | 388     | 1.4 |
| 43 North American Aviation Co., Torrance, Calif.  | 288     | 1.4 |
| 44 Boeing Aircraft Co., Everett, Wash.            | 188     | 1.4 |
| 45 Lockheed Aircraft Corp., Burbank, Calif.       | 88      | 1.4 |
| 46 North American Aviation Co., Torrance, Calif.  | 78      | 1.4 |
| 47 Boeing Aircraft Co., Everett, Wash.            | 68      | 1.4 |
| 48 Lockheed Aircraft Corp., Burbank, Calif.       | 58      | 1.4 |
| 49 North American Aviation Co., Torrance, Calif.  | 48      | 1.4 |
| 50 Boeing Aircraft Co., Everett, Wash.            | 38      | 1.4 |
| 51 Lockheed Aircraft Corp., Burbank, Calif.       | 28      | 1.4 |
| 52 North American Aviation Co., Torrance, Calif.  | 18      | 1.4 |
| 53 Boeing Aircraft Co., Everett, Wash.            | 8       | 1.4 |
| 54 Lockheed Aircraft Corp., Burbank, Calif.       | 7       | 1.4 |
| 55 North American Aviation Co., Torrance, Calif.  | 6       | 1.4 |
| 56 Boeing Aircraft Co., Everett, Wash.            | 5       | 1.4 |
| 57 Lockheed Aircraft Corp., Burbank, Calif.       | 4       | 1.4 |
| 58 North American Aviation Co., Torrance, Calif.  | 3       | 1.4 |
| 59 Boeing Aircraft Co., Everett, Wash.            | 2       | 1.4 |
| 60 Lockheed Aircraft Corp., Burbank, Calif.       | 1       | 1.4 |
| 61 North American Aviation Co., Torrance, Calif.  | 0.9     | 1.4 |
| 62 Boeing Aircraft Co., Everett, Wash.            | 0.8     | 1.4 |
| 63 Lockheed Aircraft Corp., Burbank, Calif.       | 0.7     | 1.4 |
| 64 North American Aviation Co., Torrance, Calif.  | 0.6     | 1.4 |
| 65 Boeing Aircraft Co., Everett, Wash.            | 0.5     | 1.4 |
| 66 Lockheed Aircraft Corp., Burbank, Calif.       | 0.4     | 1.4 |
| 67 North American Aviation Co., Torrance, Calif.  | 0.3     | 1.4 |
| 68 Boeing Aircraft Co., Everett, Wash.            | 0.2     | 1.4 |
| 69 Lockheed Aircraft Corp., Burbank, Calif.       | 0.1     | 1.4 |
| 70 North American Aviation Co., Torrance, Calif.  | 0.09    | 1.4 |
| 71 Boeing Aircraft Co., Everett, Wash.            | 0.08    | 1.4 |
| 72 Lockheed Aircraft Corp., Burbank, Calif.       | 0.07    | 1.4 |
| 73 North American Aviation Co., Torrance, Calif.  | 0.06    | 1.4 |
| 74 Boeing Aircraft Co., Everett, Wash.            | 0.05    | 1.4 |
| 75 Lockheed Aircraft Corp., Burbank, Calif.       | 0.04    | 1.4 |
| 76 North American Aviation Co., Torrance, Calif.  | 0.03    | 1.4 |
| 77 Boeing Aircraft Co., Everett, Wash.            | 0.02    | 1.4 |
| 78 Lockheed Aircraft Corp., Burbank, Calif.       | 0.01    | 1.4 |
| 79 North American Aviation Co., Torrance, Calif.  | 0.009   | 1.4 |
| 80 Boeing Aircraft Co., Everett, Wash.            | 0.008   | 1.4 |
| 81 Lockheed Aircraft Corp., Burbank, Calif.       | 0.007   | 1.4 |
| 82 North American Aviation Co., Torrance, Calif.  | 0.006   | 1.4 |
| 83 Boeing Aircraft Co., Everett, Wash.            | 0.005   | 1.4 |
| 84 Lockheed Aircraft Corp., Burbank, Calif.       | 0.004   | 1.4 |
| 85 North American Aviation Co., Torrance, Calif.  | 0.003   | 1.4 |
| 86 Boeing Aircraft Co., Everett, Wash.            | 0.002   | 1.4 |
| 87 Lockheed Aircraft Corp., Burbank, Calif.       | 0.001   | 1.4 |
| 88 North American Aviation Co., Torrance, Calif.  | 0.0009  | 1.4 |
| 89 Boeing Aircraft Co., Everett, Wash.            | 0.0008  | 1.4 |
| 90 Lockheed Aircraft Corp., Burbank, Calif.       | 0.0007  | 1.4 |
| 91 North American Aviation Co., Torrance, Calif.  | 0.0006  | 1.4 |
| 92 Boeing Aircraft Co., Everett, Wash.            | 0.0005  | 1.4 |
| 93 Lockheed Aircraft Corp., Burbank, Calif.       | 0.0004  | 1.4 |
| 94 North American Aviation Co., Torrance, Calif.  | 0.0003  | 1.4 |
| 95 Boeing Aircraft Co., Everett, Wash.            | 0.0002  | 1.4 |
| 96 Lockheed Aircraft Corp., Burbank, Calif.       | 0.0001  | 1.4 |
| 97 North American Aviation Co., Torrance, Calif.  | 0.00009 | 1.4 |
| 98 Boeing Aircraft Co., Everett, Wash.            | 0.00008 | 1.4 |
| 99 Lockheed Aircraft Corp., Burbank, Calif.       | 0.00007 | 1.4 |
| 100 North American Aviation Co., Torrance, Calif. | 0.00006 | 1.4 |

|   |              |     |
|---|--------------|-----|
| 101 North American Aviation Co., Torrance, Calif. | 0.00005      | 1.4 |
| 102 Boeing Aircraft Co., Everett, Wash.           | 0.00004      | 1.4 |
| 103 Lockheed Aircraft Corp., Burbank, Calif.      | 0.00003      | 1.4 |
| 104 North American Aviation Co., Torrance, Calif. | 0.00002      | 1.4 |
| 105 Boeing Aircraft Co., Everett, Wash.           | 0.00001      | 1.4 |
| 106 Lockheed Aircraft Corp., Burbank, Calif.      | 0.000009     | 1.4 |
| 107 North American Aviation Co., Torrance, Calif. | 0.000008     | 1.4 |
| 108 Boeing Aircraft Co., Everett, Wash.           | 0.000007     | 1.4 |
| 109 Lockheed Aircraft Corp., Burbank, Calif.      | 0.000006     | 1.4 |
| 110 North American Aviation Co., Torrance, Calif. | 0.000005     | 1.4 |
| 111 Boeing Aircraft Co., Everett, Wash.           | 0.000004     | 1.4 |
| 112 Lockheed Aircraft Corp., Burbank, Calif.      | 0.000003     | 1.4 |
| 113 North American Aviation Co., Torrance, Calif. | 0.000002     | 1.4 |
| 114 Boeing Aircraft Co., Everett, Wash.           | 0.000001     | 1.4 |
| 115 Lockheed Aircraft Corp., Burbank, Calif.      | 0.0000009    | 1.4 |
| 116 North American Aviation Co., Torrance, Calif. | 0.0000008    | 1.4 |
| 117 Boeing Aircraft Co., Everett, Wash.           | 0.0000007    | 1.4 |
| 118 Lockheed Aircraft Corp., Burbank, Calif.      | 0.0000006    | 1.4 |
| 119 North American Aviation Co., Torrance, Calif. | 0.0000005    | 1.4 |
| 120 Boeing Aircraft Co., Everett, Wash.           | 0.0000004    | 1.4 |
| 121 Lockheed Aircraft Corp., Burbank, Calif.      | 0.0000003    | 1.4 |
| 122 North American Aviation Co., Torrance, Calif. | 0.0000002    | 1.4 |
| 123 Boeing Aircraft Co., Everett, Wash.           | 0.0000001    | 1.4 |
| 124 Lockheed Aircraft Corp., Burbank, Calif.      | 0.00000009   | 1.4 |
| 125 North American Aviation Co., Torrance, Calif. | 0.00000008   | 1.4 |
| 126 Boeing Aircraft Co., Everett, Wash.           | 0.00000007   | 1.4 |
| 127 Lockheed Aircraft Corp., Burbank, Calif.      | 0.00000006   | 1.4 |
| 128 North American Aviation Co., Torrance, Calif. | 0.00000005   | 1.4 |
| 129 Boeing Aircraft Co., Everett, Wash.           | 0.00000004   | 1.4 |
| 130 Lockheed Aircraft Corp., Burbank, Calif.      | 0.00000003   | 1.4 |
| 131 North American Aviation Co., Torrance, Calif. | 0.00000002   | 1.4 |
| 132 Boeing Aircraft Co., Everett, Wash.           | 0.00000001   | 1.4 |
| 133 Lockheed Aircraft Corp., Burbank, Calif.      | 0.000000009  | 1.4 |
| 134 North American Aviation Co., Torrance, Calif. | 0.000000008  | 1.4 |
| 135 Boeing Aircraft Co., Everett, Wash.           | 0.000000007  | 1.4 |
| 136 Lockheed Aircraft Corp., Burbank, Calif.      | 0.000000006  | 1.4 |
| 137 North American Aviation Co., Torrance, Calif. | 0.000000005  | 1.4 |
| 138 Boeing Aircraft Co., Everett, Wash.           | 0.000000004  | 1.4 |
| 139 Lockheed Aircraft Corp., Burbank, Calif.      | 0.000000003  | 1.4 |
| 140 North American Aviation Co., Torrance, Calif. | 0.000000002  | 1.4 |
| 141 Boeing Aircraft Co., Everett, Wash.           | 0.000000001  | 1.4 |
| 142 Lockheed Aircraft Corp., Burbank, Calif.      | 0.0000000009 | 1.4 |
| 143 North American Aviation Co., Torrance, Calif. | 0.0000000008 | 1.4 |
| 144 Boeing Aircraft Co., Everett, Wash.           | 0.0000000007 | 1.4 |
| 145 Lockheed Aircraft Corp., Burbank, Calif.      | 0.0000000006 | 1.4 |
| 146 North American Aviation Co., Torrance, Calif. | 0.0000000005 | 1.4 |
| 147 Boeing Aircraft Co., Everett, Wash.           | 0.0000000004 | 1.4 |
| 148 Lockheed Aircraft Corp., Burbank, Calif.      | 0.0000000003 | 1.4 |
| 149 North American Aviation Co., Torrance, Calif. | 0.0000000002 | 1.4 |
| 150 Boeing Aircraft Co., Everett, Wash.           | 0.0000000001 | 1.4 |

#### Miniature Satellite

Telemetry-based satellite, developed by Space Technology Laboratories, will be flown piggyback aboard Minotaur or Scout spacecraft to measure radiation damage to solar cells on each of its four faces (AVF June 18, p. 25). The satellite, weighing less than 1 lb. and measuring less than 1 in. along any axis, contains three solar cells and will separate and handle fuel from the parent vehicle in space.



## Beech works wonders with titanium to save weight...increase space payloads

**Largest titanium structure ever built, and Beech built it.**

The large tank in this picture is made entirely of titanium. Built by metal-working experts at Beech to hold 7,000 gallons of pressurized liquid hydrogen, the tank is eight feet in diameter and 24 feet long. This remarkable tank weighs only 460 pounds.

This means more payload.

Fabricating titanium is an old story at Beech. And it's something that's never been done before, there's not unusual. In this case the upper and lower hemispherical tank heads were chemically milled in a complex pattern to extremely close tolerances.

Production welding of .012" titanium is S.O.P. at Beech. Much of the equipment used by the Aerospace Division is one-of-a-kind and must be designed and built under the most rigid controls. Other jobs make use of Beech's extensive metal bending capabilities.

Sophisticated fabrication is one of the many elements that make up the comprehensive Beech capability. It's one reason Beech is well prepared to undertake complete systems management responsibilities for a wide range of space-age projects.

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## AERONAUTICAL ENGINEERING

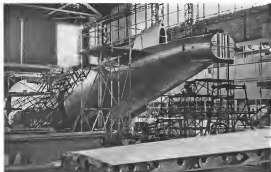


First prototype of the C-160 Transall twin turboprop transport, a joint French-German project, is assembled at Nord Aviation's facility at Melun-Villaroche for a Nov. 15 target for first flight. Nose, which holds the wing, is responsible for mobility of the first airplane.

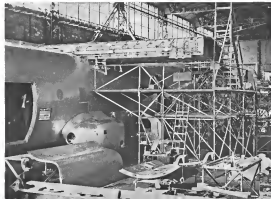
### French Assemble First C-160 Transall, Super Frelon



First prototype of the first S219 Super Frelon helicopter, due to fly in December, is assembled at Sud's Marignane plant. Unlike the prototype S219 Falco, the Super Frelon has a three-blade main rotor like the Sikorsky HO4S. Sikorsky has a technical assistance contract with Sud, largely concerned with dynamic components and test of the first all-Blade rotor system has begun in the Sikorsky wheel stand. Tail rotor wheel tests started last week and Sikorsky has shipped the first rotor assembly line blades to Sud for test. Powerplants on three Turbomeca T550 IC turbine engines developing 1,315 shp—had a testing for a 300-helicopter maximum production run.



Center section wing box is mated to the fuselage of the first Transall prototype. Westinghouse, one of three German companies taking part, is overall project manager and leads the fuselage and tail sections. Second and third prototypes will be assembled in Germany before tail fitting subengines complete. Here, and the landing gear fittings are joined to the fuselage (below). Powerplants for the Transall transport are two Rolls-Royce Tyne RTy 23 turboprop engines.





Production version of the Dassault Mirage 3B, the first delivered to the French air force in June, carries Mark 2 housing an experimental intake cryogenics. Armament includes two 30 mm DDEA cannons in forelegs pods, Matra R 530 (on higher stand, right) and Sidewinder (below, right) air-to-air missiles. Ejector seat is Hispano-built Martin Baker Type ASM-6.

## Mirage 3B Deliveries Begin; 3C in Production

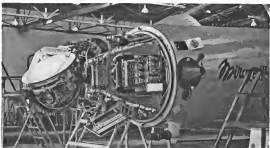
Mirage 3B are shown on the line at Dassault's plant near Bordeaux. Production rate is one per month.



Mirage 3B auxiliary model engine starts test on a Dassault Mirage 3C, the production version of the Mirage 3A. The engine develops 1,500-hp thrust for 60 sec. or 3,000-hp thrust for 30 sec.



Stores for the Mirage 3B also include the Nord AS 30 air-to-air missile (left) and wing-pylon-mounted pod housing wing-fuel sockets and additional fuel. Nine-mounted CSF Cresson gun control radar (bottom photo) is used on the Mirage 3C.





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**NEW METHOD TESTING** Assures motor reliability without material loss.

## DOD Group Studies Emitter Interference

By Philip J. Klaus

Annapolis, Md. — Little-publicized problems with patterns, grave consequences for the nation's military forces, resulting from the increasing numbers of radio and radar equipments now in use, is under attack here by the recently formed Defense Department Electromagnetic Compatibility Analysis Group (ECAC).

Mutual interference among radars, radios, telemetry and other radio frequency facilities is posing increasingly troublesome problems, providing a warning of what could be expected in a warfare environment where many more equipments would be in operation.

ECAC, established last summer as a new joint service facility, represents a Defense Department effort to coordinate interference problems and to achieve better control for the future in new equipment developments and in place of existing programs.

### Managed by ESD

The new facility, headed by Col Charles G. Workman, USAF, is presently assigned by Air Force Systems Command's Electronic Systems Division.

The center is largely staffed by personnel employed by the Annapolis Re-

search Foundation, which carries out technical operations under contract to USAF.

A few examples illustrate the scope of the problem which has been assigned to ECAC:

- **Rad-Cop** study several years ago at the frequency division data link developed for guidance of the B-57C aircraft revealed that it was extremely vulnerable to interference from other military equipments likely to be operating in the same environment. The B-57C intercepter was changed over to use a time-division multiple data link system.

- **Air defense radar** in the Southern California area has encountered a major interference problem because of their concentration and the topography of the area. New frequency division system, being installed by Air Force for air defense use, are causing interference with civil services, such as television, in some locations.

- **Test facilities**, such as Eglin AFB and Cape Canaveral, have encountered such severe interference problems that it is necessary to halt work and shut down power equipments prior to a weekly launch or space mission to assure proper operation of acquired telemetry and control systems.

The interference problem is almost

staggering in its complexity. Electromagnetic radiation knows no board lines. Frequencies normally limited to line-of-sight range can propagate over larger distances due to atmospheric disturbances, radio ducts formed by temperature inversions, troposphere or ionosphere scattering, or ionosphere obstructions over mountain tops. New data radio image support differences between services, or between civil and military equipments. Air Force radar can interfere with an Army telemetry link or a civil television station.

Transmitters designed to radiate in one band often radiate spurious signals at other frequencies. Stations that are designed for peak sensitivity in one band may be responsive also to other frequencies.

A recent investigation has revealed, for example, that the spectrum of a radio receiver in signals outside the desired band may be significantly changed from original performance when equipment is in transit in the field.

In a typical area covering line-of-sight distances, there may be as many as 24,000 different sources of radio signals, including both civil and military. The situation is fluid, with transmitters and receivers changing frequency and new stations entering the area while others leave.

"Any attempt to determine interference problems by conducting 'Victory' magnetic surveys' would be prohibitive in cost, expense, if not impossible," according to A. L. Hirsch, Rad-Cop scientist who serves ECAC as a consultant.

### Solution Sought

For this reason, ECAC seeks to develop techniques and gather data which will enable it to carry out mathematical studies and analyses to predict some known problems and to develop methods for reducing interference, according to J. Paul Gentry, technical director here. In accomplishing this objective, ECAC currently is in the process of acquiring two basic types of information:

- **Spectrum** information, a catalog of the electronic characteristics of all major types of military transmitters and receivers. For transmitters, this will include such things as output power, spurious emissions, emission spectra, modulation characteristics, intermodulation, modulation bandwidth and carrier frequency stability.
- **Receiver** characteristics, data which will be cataloged include sensitivity, selectivity, spurious response, overall susceptibility, intermodulation,



This airplane detects, early warns, controls intercepts, and has a heart.



This is the heart.

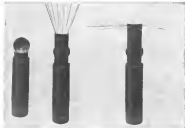
The airplane belongs to the U. S. Navy. It is a German WZ-1 Hawkeye. It is one of the latest carrier based aircraft, is manned by a crew of five and was designed to perform airborne early warning missions. Technically, for long range radar detection and control of intercepts with minimum reaction time.

The heart of the WZ-1 is its avionic electrical system: two Bendix® Type 28095-3, 60 KVA AC brushless generator systems driven by the airplane's turboprop

engines. These brushless systems—along with common Bendix solid state regulation and protection systems—provide reliable, efficient electrical power to help the Hawkeye do its job. This is a big one.

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Red Bank Division



### Antenna Withstands Thermo-nuclear Blast

Model of 120 ft. antenna developed by Solvex Electric Products, Inc., is withstood thermo-nuclear explosion from 400 lbs. shell and equals to full operational position. Antenna's performance would equal that of a 120 ft. high conventional antenna.



### Traveling Wave Laser

Traveling wave laser emitting at end of glass fiber optic device with Newhouse reportedly achieves most efficient use of pump energy. Developed by Massco Fibers, Inc., new laser consists of broad bundle of single optical fibers with total internal reflection characteristics. Less than 40 points of pump power are needed to initiate laser action at laser input/output.

adjacent signal interference; pulse discrimination, C/W discrimination, dynamic range and oscillator reduction.

- Environmental file, a listing of every military transmitter-receiver, its location, type of antenna, surrounding the transmitter/receiver, normal on/off duty cycle, operating frequency, antenna deviation above its level, antenna aiming azimuth, etc.

### Spectrum Signature

Initially, ECAC is confining its data collection efforts on obtaining position signatures and environmental files on point-type radar operating above 100 m in the Zone of Interest.

Presently, ECAC has spectrum signatures on five pulse radar and hopes to increase this to approximately 150-200 by next year. The challenge, the reconnaissance required to obtain a spectrum signature are costly and time-consuming. ECAC is using data available from equipment technical manuals for preliminary analyses until full spectrum signature data becomes available. It now has such needed data on approximately 35 additional radars, plus full spectrum signatures on about 75 communications equipment previously gathered by Georgia Institute of Technology.

Each of the military services is responsible for collecting environmental data and spectrum signature data for its own equipment and facilities, using either its own personnel, an outside contractor or both. Each of the services has, or will have, a deputy director assigned here to provide liaison.

Survey forms to gather data for the environmental file have just gone out to military facilities in the Middle Atlantic states. Survey forms will go out to each of the other Zones of Interest regions at two-month intervals, according to R. B. Wise, head of the information processing department.

To make use of the spectrum signature and environmental file data, it is necessary to develop mathematical models which describe conditions under which interference occurs and the factors which influence the severity of the interference. To speed the analysis, these models must be designed to permit their use in digital computers.

The Georgia Institute of Technology, under subcontract to Amstar Research, currently is developing these mathematical models.

### Basic Model

The basic model, called a one-factor interference analysis, considers a single transmitter in an interference source by a single receiver, taking into account such factors as aiming direction of transmitter antenna, its sidelobe pattern, power density, spectrum of emitted energy, normal azimuth over the frequency band, its threshold setting, and in the case of a radar, the apogee when the interference will present on the radar scope. A few such models will be developed for broadside direct types of equipment.

A second type of model under development, called a "element model," will describe mathematically the operation of special circuit functions, such as receiving target indicator and last time constant components.

By combining an appropriate basic model with suitable element models, it should be possible to make up with a mathematical model equivalent of any specific operating equipment, according to Paul D. Newhouse, head of the ECAC antenna department.

Additional models are being developed to introduce the effects of propagation characteristics. Still another, called a system model, will cover a situation where two different types of equipment are involved, such as a radar and a communications equipment.



### Transportable Antenna

Transportable high frequency Doppler radar antenna, weighing less than 1,000 lb., uses 100 ft. parabolic concentrating mast and can be installed in eight hours according to manufacturer, Andrew Corp., Chicago. An erect has horizontal plane beam width of 100 deg.

Finally, models will be developed to present what parameters in an equipment are most likely to be changed by various situations.

By November, the center has expected to have installed a large, high speed Univac 1107 which will be used to carry out analysis using the mathematical models and data obtained from current equipment and environmental sources.

To handle typical situations in which there may be 10,000 radio frequency emitters in an area under study, ECAC is developing a three-stage "accumulator program." From data on all 20,000 emitters, the computer will search out those, perhaps 10%, which characterize radars, missiles, possible interferences.

In the next stage of operation, these 2,000 potential interference equipments will be analyzed in more detail to find perhaps another 30% which are probable interference problems. In the final stage, those remaining 100 would be analyzed in detail to obtain a statistical probability distribution of the likelihood of interference for any specific equipment, Newhouse said.

### Model Validation

To prove the accuracy of the mathematical models, upon which future interference analysis will be based, ECAC is sponsoring three model validation tests, according to Herbert M. Sachs, ECAC deputy director for technical operations.

The validation tests are as follows:

- **Radar Air Development Center** has recently completed tests to check the propagation model and terrain effects upon a one-on-one radar model. Tests were run using two L-band model facilities, the AN/TPS-30 and the AN/TPS-1D.
- **Naval Air Navigation Electronic Project, Patuxent River, Md.**, is checking the basic one-on-one interference model for two radar using two L-band surveillance radars, the AN/TPS-1D and the AN/SPS-6G.
- **Air Force Electronics Group, Ft. Monmouth, Ariz.**, will test the model for multiple radars, using five M-33 surveillance radar operating at S band and six receivers. Tests will involve propagation over smooth terrain and reflections from mountains.

The Navy tests will include experiments designed to determine the effect on interference of using components made by different manufacturers. This covers the subtleties of different sizes of magnets, crystal dopes and local oscillators.

The Defense Department has given a number of specific, troublesome interference problems to ECAC either to obtain solutions or to double-check proposed solutions. This gives the new center practical experience in current

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250 VA Static Inverter

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Output Voltage: 250 VAC single phase 0-180 to 1-0 power factor  
Power: 175 VA  
Regulation: 185 V adjustable from 180 to 190 volts 1-watt change for any variation of load between zero and 110% of full load and output voltage between 80 VDC and 30 VDC  
Frequency: 400  $\pm 5$  cps  
Frequency changes less than 1.0 cps for all maintenance, load and input voltage variations  
Distortion: Less than 5% total harmonic  
Efficiency: 80% at full load

#### 250 VA STATIC INVERTER

Input Voltage: 27.5 VDC  $\pm 10\%$  per MIL-STD-706  
Output Voltage: 250 VAC single phase 0-180 to 1-0 power factor  
Power: 250 VA  
Regulation: 115 V adjustable from 110 to 120 volts 0.7 volt for any variation of load between zero and 110% of full load, and output voltage between 25 VDC and 30 VDC  
Frequency: 400  $\pm 5$  cps  
Frequency changes less than 1.0 cps for all maintenance, load and input voltage variations  
Distortion: Less than 5% total harmonic  
Efficiency: 80% at full load

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## NEW CHALLENGE

— of significance to United States ballistic missile programs

— of unusual interest to engineers and scientists

DURING THE NEXT FEW MONTHS the U. S. Air Force Ballistic Systems Division will shift its operations from Los Angeles to Norton Air Force Base near San Bernardino.

Consequently, there is being established the San Bernardino Operations of Aerospace Corporation, the unique public trust organization formed in June 1960 to serve the U. S. Government. This action will ensure continued and even to technical progress in the advanced programs of the Ballistic Systems Division.

Several of the principal ballistic missile programs plus advanced programs of the future will be shaped at San Bernardino. Concentrated in this friendly community is a sufficient number of the nation's best brains will function in close interdisciplinary teamwork. San Bernardino will be a place of challenging programs and deep satisfaction for people concerned with Aerospace drive for aerospace supremacy.

The San Bernardino Operations will work closely with the established and growing Aerospace organization at El Segundo, where approximately 3600 are now working in a broad, diversified system spectrum. The El Segundo staff provides all advanced systems research and planning, general systems engineering and technical direction of well established ballistic missile and space programs, and laboratory research to anticipate and evaluate significant state-of-art developments.

Technically, the new organization will include thousands of people, with a large proportion of engineers and scientists, widely known for their technical ability, experience, imagination and leadership. Opportunities for advancement and promotion can be expected to be considerably above average for those engineers experienced in and capable of program management, technical direction, advanced system development and analysis of ballistic missile systems.

Similar opportunities exist for engineering specialists in such fields as propulsion, fluid mechanics, solid mechanics, performance analysis and computer, guidance and control, communications, data computation, orbital mechanics, trajectory analysis, radar and optical. The new modern facilities will be located within ten minutes drive of several attractive neighborhoods. People working here will have a chance between living in warm dry country or higher, cooler hill country. Yet Los Angeles is within a easy drive on a nonstop freeway.

Aerospace looks forward to staffing its new offices with motivated qualified individuals who can contribute to the work of strengthening national defense. The opportunity is immediate. Applications are being reviewed now. Write to Mr. Charles Lockwood, Room 1011, Aerospace Corporation, Box 99581, Los Angeles 45, California. Aerospace is an equal opportunity employer.

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problems and an opportunity to test some of its concepts. Carefully assigned operational problems include the following:

- **San Diego problem**, involving interference between air defense radar in the Southern California area. Initial field measurements have been completed and a more detailed set of measurements is scheduled to get on air in August. This will include statistical data on pulse amplitude, frequency, separation and pulse width distribution.

- **MCAIDS problem**, involving interference from radar in the Manassas Air Defense Sector of Sept. Equipment involved in the system includes radars operating in the 215-400 mc. band, FM telemetry, FM ground alert, and ground air voice communications at Elgin AFB, Fla.

- **Chester Bay problem**, involving interference among radar over the ocean from A-10 and F-104.

- **Spaulding problem**, a short term analysis of possible interference from Air Force's new electronically scanning radar detection and tracking radar under development by Bendix Radio.

Technical Director George emphasizes that ECAC's role is that of a consultant and adviser to the Defense Department, the individual military services, and to industry designers. The center has no responsibility to resolve interference problems.

Data and knowledge acquired by the center will serve as case data source for the Interdepartmental Radio Advisory Committee (IRAC), which makes frequency assignments to government users.

In addition, ECAC expects to serve as a consultant to individual services in planning new equipment programs to minimize possible interference with other equipment used by other services. ECAC also expects to help operational commanders develop optimum methods to minimize interference problems. This service also should be of value to industry designers developing new equipment, to minimize the likelihood of interference problems.

The Defense Department's program to reduce this problem encompasses other areas beyond the scope of ECAC's operations.

For example, ECAC intends to emphasize reduction of spurious emission in the development of new radar and equipment.

ECAC is located at the Naval Engineering Equipment Station in Annapolis. The center expects to have a staff of about 150 by August, the majority of them professionals.

Depth description on days with ECAC from the center services, write E. J. Callahan, A. C. Calk, USA, Cdr Albert M. Brown, USN, and Mr. Gilbert G. Nicholas, USAF.

## FILTER CENTER

• **Boost for Transistor Reliability**—Hickok Semiconductor is adapting its all its transistor products a pioneering technique which replaces the potentially troublesome thermal-bonded contact leads made the transistor can with solid solder connections. The bonded connections between the three active regions of a transistor and bonding pads on a lead are long been a source of difficulties which should be eliminated with this technique, according to the company.

• **Liquid Laser Operation Reported**—First successful operation of a liquid laser, using new technique developed which rubbers in the green part of the spectrum, has been reported by Sema Elements, Inc., Bensenville, Ill. When pumped with an ultraviolet source, the new rubbers liquid laser rubbers in the 3,400 to 5,800 angstrom region, a wavelength which penetrates ocean depths permitting application for underwater communication and detection. Previous attempts to achieve liquid laser action using other materials have been unsuccessful because host lattice liquid and container absorbed too much pump energy. Sema Elements does not reveal the host liquid used but says it has applied for patents. The new technique for putting the liquid elements into solution and vapor for laser use. The company is offering new rubbers liquid laser material for sale at \$130 per oz. in minimum quantities of 35 oz., with lower prices on larger quantities.

• **Infrared for Aircraft Communications**—A system for aircraft-to-ground communications using infrared instead of radio frequencies to provide secure and private messaging is being developed by Santa Barbara operations of Remington's Missile and Space Division. There is 18-inch infrared source, the company expects to achieve communication ranges of up to 100 mi. To enable initial contact between two moving aircraft, such will form an infrared beacon while automatically scanning for the 18 radiation of the other. Once acquisition has been made such aircraft referred "infrared" will automatically lock on to radiation of the other to permit communication through maneuvers and evasions of the aircraft.

• **Radio, Infrared Exports Up**—Japanese exports of electronic products to the U. S. totaled more than \$120 million in 1964, an increase of 20% from previous year while United Kingdom exports to the U. S. rose \$22.7 million, an increase of 14% over 1964, according

to figures released by Commerce Department's Bureau of Economic and Defense Services Administration.

• **Duplex System Bibliography**—General-Air, extensive bibliography of published information on duplex systems, signals and systems, including foreign engineering studies and some previously classified reports, is listed in a 316-page book entitled "Duplex Systems," classified AD-585-513, now available from the Commerce Department, Office of Technical Services, Washington 25, D. C. Price is \$1.00.

• **Signal on the Dotted Line**—Major contract awards recently announced by aerospace manufacturers include:

- **General Precision, Inc., G.P.I. Division**, will in originate use of laser in airborne and ground-based systems under a \$11,300 contract from USAF's Air Control Systems Division. The company's Laserphone Division reports a \$19.9-million AEC contract to build an airborne digital navigation computer for the USAF/Lockheed C-141 transport.

- **Hawlett Corp., Little Neck, N. Y.**, will supply a new-developed Spolar 220 digital differential analyzer to the Wright Air Development Center. The computer has a 300-ke, duration rate, making it much faster than a digital general purpose computer in solution of differential equations; the company

- **ITT Federal Laboratories, Ft. Wayne, Ind.**, will design and build a homing radar tracker and created large unit for use in the Offshore Atmospheric Observation (AOO) under contract awarded by Grumman CMO prime contractor.

- **Minneapolis-Honeywell, Hartford, Conn.**, will supply magnetic tape recording and recording systems for use in Project Vela. Joint Service nuclear warhead testing totaling more than \$1 million received from several contractors participating in the Defense Department project. The awarded will operate at tape speeds of 9.6 in./sec.

- **Martin Co., Electronic Systems & Products Division, Bedford**—contract from the Office of Naval Research for an infrared background measurement study, using the company-developed, multi-channel infrared detector array. The project is part of ONR's program to develop improved aircraft detection systems. The division also reports a \$114,660 contract from NASA to fabricate six infrared beams, sensors and power supplies for sensing attitude of the second stage of the Saturn space booster.

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## Power Interruption Slashes Gyro Drift

Minneapolis-Honeywell has cut the drift rate of its integrating gyro over a two-way range from 101 to as much as 48.8 by the simple technique of interrupting power low to the spin motor periodically in a precisely controlled cycle.

The new approach, called spin motor interruption technique (SMIT), will be employed in Honeywell's gyro used in the Dyna-Star line, called the N-35, Green, Green and the SD-5 series. The company has applied for a patent on the idea.

The SMIT concept resulted from an investigation by Honeywell's St. Petersburg, Fla., service facility to discover why gyro would drift excessively in use shortly after they had been calibrated (trimmed) to take out such drift. The assumption was that of some imbalance of the gyro rotor, but study of gyro returned from the field failed to disclose such rotor imbalance.

### Drift Tests

Extensive tests at St. Petersburg revealed that drift occurred as a result of power interruption or transient in the power supply. Interruption occurs during periodic testing and shut-down of the gyro during pre-launch tests and when gyros are switched from launch site power to master/booster power supply.

From these investigations came the idea, credited to Ralph Foston and Will Ross, of intentionally interrupting the power to the spin motor for precisely controlled amounts in precisely controlled cycles. Instead of aggravating the situation, this overcomes the condition, drift from this source, according to Foston.

Honeywell has tried a variety of different SMIT cycle times and has adopted the following as optimum for current gyro. Power on for 1.86 sec, followed by power off for 0.275 sec, followed by repetition of the cycle.

### Platform Tests

To illustrate the improvement obtained through application of SMIT, Honeywell ran tests on unbalanced platform in which gyros were run up and shut down a number of times, as they would be in normal use, and compared drift rates both with and without the new technique.

In one platform, maximum gyro drift rate experienced during 15 start up, shut-down operations without spin motor interruption technique was 0.40 deg. per hour, compared with only 0.01 deg. per hour, when SMIT was employed. Another gyro after an shut-down, start-up operation had a maximum drift rate of 0.35 deg. per hour without SMIT, but a drift rate

of only 0.04 deg. per hour when the new technique was used.

Still another gyro had its maximum drift rate slashed from 0.4 deg. per hour to only 0.02 deg. per hour when the new technique was employed, according to Honeywell.

Tentative use of the improved stability resulting from use of SMIT should eliminate the need for pre-launch calibration for many applications, and as well reduced drift after launch despite transients in the master power supply. Additionally, Foston figures higher yield in gyro manufacturing operations because a major source of drift is eliminated.

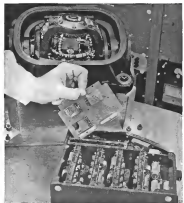
### Principle of Operation

The basic cause of previous instability in gyros, and the explanation of the spin motor interruption technique, involves the fundamental principles of operation of the synchronous hysteresis motor used to spin the gyro rotor.

In a hysteresis motor, when the spinning rotor comes up to speed it is magnetically locked into synchronous with the rotating field created by the stator and will remain in such position as long as there are no transients or power interruption.

The rotating field produced by the three-phase motor winding, excited from a three-phase a.c. supply, appears to the rotor to be a bar magnet which is rotating at the frequency of the a.c. supply, although in reality the stator is fixed. The rotating field induces hysteresis currents in a steel ring and windings which line the stator circumference of the spinning rotor. The fields produced by these hysteresis currents react with the stator field to cause the rotor to spin.

When the rotor is spinning at synchronous speed, the stator field produces magnetic poles in the hysteresis ring which are opposite the poles of the stator bar magnet. For example, in



GYRO DRIFT RATE has been reduced by factor of 18.1 to 48.1 by Honeywell using three small modules shown above which periodically interrupt power to gyro spin motor for precisely controlled intervals, averaging out effects of transients. The company calls the new process SMIT (spin motor interruption technique).



FIXED GROUND STATION "RADOM" AT ANDOVER, MAINE. Ship antennas (left) now take use of band concentrates capable to filter in a narrow, downward beam. The same antenna also receives extremely weak signals coming from Telstar and amplifies them before relaying.

## New "TELSTAR" relays phone calls and TV pictures for first time!

**Bell System microwave-in-sky satellite is latest communications triumph for America arising from telephone research**

The world's first private enterprise communications satellite is now being used for dramatic experiments in relaying telephone calls and television independently.

In 1962, Telstar, it was launched from Cape Canaveral in Bell System expense by the National Aeronautics and Space Administration.

Telstar relays signals beamed to it from a ground station, amplifies them and retransmits them to another station on the ground below—perhaps as across away from the first one. The new satellite thus acts as a microwave relay station in the sky, relaying voices, TV pictures and data messages to keep thousands of miles in a new and exciting way.

The ground station is the U.S. new being and for Telstar was built by the Bell System at Andover, Maine, and Holmdel, New Jersey. Organizations around have built stations in England and France. The latter, a near replica of the station in Maine, was assembled with Bell System cooperation. A receiving station in Italy will be ready by this year, and another in West Germany next year.

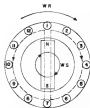
Telstar is a major experimental step toward a world-wide satellite communications system that was first proposed as a joint venture at Bell Telephone Laboratories. Progress toward such a system has depended on major contributions by the private companies whose industry, including its basic components—the transmitters, the solar batteries, the traveling wave tube, ruby masers, the waveguide, and new antennas for the ground stations with sensitive low-noise—direct amplifiers of Bell System research and development.

Above all else, Telstar is the latest achievement in an ongoing Bell System quest to develop ever better communications for both civilian and military applications.



**BELL TELEPHONE SYSTEM**

ANDOVER, TEL. 4 / TEL. 30 / WESTERN ELECTRIC CO. BELL TELEPHONE LABORATORIES / IN OPERATING COMMERCIAL



**SPIN MOTOR** saturation technique, for shifting gyro drift, is based on fact that rotating field produced by rotor center induces poles at two points in surrounding coils—(6) and (7) in example shown. How does transients in saturation of gyro point cause rotor to lock in at different points, causing shift of mass balance and drift.

shown in the accompanying sketch these poles are located at points (1) and (7) on the left-hand ring.

So long as there is no power interruption or transient, points (1) and (7) will always be aligned with the direction of the rotating static field (not magnet). But if there is even a brief loss of power, such as switching over from battery and to main power supply, first the rotor will locate drop out of synchronism with the static field.

When power is restored the rotor will again return to synchronous speed, but when it locks into the static field, the location of the poles produced in the rotor will be at a different location. For example, they might be at points (1) and (9), or at (4) and (10).

### Idealized Conditions

If a rotor were perfectly homogeneous and perfectly balanced, and if its bearings were identical and perfectly balanced, the location of the poles produced in the rotor would be at a different location. But in practice, these idealized conditions are not achieved in the precision required for extremely low drift gyro tolerances. The result is similar to that caused by mass imbalance of the rotor.

Even with a steady power supply source, slight changes in motor load can cause a slow drift in magnitude of the rotor poles, producing a slow, long-term drift of the gyro. Friction says. This means that a gyro can be carefully trimmed during post-launch calibration to take out drift, but when the gyro is switched down from use to conserve internal power, however, the rotor will lock in at a different position. This

largely nullifies the effect of the previous calibration.

Henceforth, tests confirmed that drift was a function of the particular rotor lock in (spin), position, and that was something which could not be controlled in gyro use.

The solution, as devised by Fortson and Mery, was to intentionally keep the gyro rotor to flip through a complete revolution every 20 sec. so that the second poles would appear regularly around the rotor periphery, thereby averaging out the drift for all lock points.

This approach bears some similarity to the technique known in Fortson devised by Sperry Gyroscope Co. to cope with spin-axis losses in gyro gimbals bearings (NAV JOURNAL, Feb. 17, 1960, p. 10). This method the use of a wobble motor to rotate the entire mass of gyro gimbals bearings in opposite direction, with periodic reversal of direction. The unpredictable spin-axis losses are thus averaged out, and the entire gyro rotor shifts, first in one direction and then in another, to average these out.

However, a first design approach to SMT has been to use a small instantaneous switching device to remove excitation from one phase of the three-phase motor winding for the 375 milliseconds, after which power is again applied for approximately 2.56 sec. The SMT circuit for three gyro rotors occupies approximately 6 cu. in. and weighs a few ounces, not including the cyclic timing clock. When the motor returns, a digital computer for comparison of the rotor position, its own position, and its timing sequence, can be used to control the timing sequence.

A more sophisticated SMT control technique, now under development, is expected to achieve more precise control of the rotor flip and thereby to improve drift rate. It will shift the phase of the a.c. power supplied to all three rotor windings in 180 deg. increments, thereby causing the rotor to lock in precisely in 180 deg. increments around its circumference, according to Fortson.

### Mosaic Radome

Industry proposals for mosaic radome for LORACAT space on future antenna vehicles maneuvering at high speeds in the stratosphere will be submitted July 31 to manufacturing technology branch of AFMCS, Aeronautical Systems Division. Contract issued to cover three phases to start expected before October.

First phase will be a three-month study of state-of-the-art literature. Second phase, spanning nine months, will cover development and selection of materials. Third phase will be a six-month effort on the construction of either a prototype or scale-model dome.



## for the Minuteman: Engineered Environment

The untamed underground world of the USAF Minuteman presents extreme environmental problems. Yet the missiles must remain operational continuously—ready to perform instantly at all times. Helping the Air Force meet this reliability challenge, American Air Filter developed and is producing and installing the environmental Operational Ground Equipment required. American Air Filter maintains a total capability to design and produce such environmental control systems—keeping current both in increasing knowledge and in research, testing, and manufacturing facilities. For example, AAF has sustained compliance with Specifications MIL-H-27142, G-34-07-55-261A, and G-34-07-55-261A.

Cost and risk of capability help solve an environmental control problem for you? Inquire: Defense Products Division, American Air Filter Co., Inc., 320 Fifth Street, Rock Island, Ill., Phone 738-5311.

with the August 1961

ENGINEERED ENVIRONMENTAL SYSTEMS

COMPLETE SYSTEMS CAPABILITY

- Heating
- Cooling
- Air Conditioning
- Dehumidification
- Filtration
- Gas Control



THE PROBLEM



THE HARDWARE



THE CAPABILITY

## It takes an understanding of all 3 to build a hydraulic system

*It takes system engineering experience. The solution to the problem may depend on hydraulic knowledge, but it is hardly ever restricted to that one engineering discipline. At Crane's Hydro-Aux Division, we've got the experience in all three areas available in two ways. First, the engineering disciplines range from hydraulics to electro-mechanical, electronics and pneumatics. Second, there is continuous practice in combining these disciplines in system design. Recent outstanding examples: the complex relationship of electronics and advanced hydraulics in our infrared, laser and automatic brake torque control system.*

*A detailed report on our products, facilities and capabilities in advanced hydraulics has just been completed. May we send you a copy?*

*It takes system-oriented hardware. Hydro-Aux record as a developer of vehicle hydraulic controls stretches over two decades. We built our first hydraulic valve in 1943. Six of thousands of valves, pumps, motors, actuators and other controls have followed this tradition. Recent developments include servo valves, variable displacement hydraulic pumps, a new oil-voiding development for hydraulic motors, a new lightweight turbine-driven pump. Today, a whole family of "remote generation" hydraulic controls and components from Crane's Hydro-Aux Division performs in integrated systems—in cars, space vehicles, missiles and jets.*

*It takes up-to-date facilities. Hydro-Aux's newest "dismount room"—just completed—can control dust count to Class 100 standards (1.0 microns). Our back temperature hydraulic test facility contains equipment suitable for operation at temperatures more than one-third higher than the limitations of present hydraulic fluids. It also includes advanced test systems, an Orson 3200 test system, four static test systems and two "Skydrol 505" test systems. For the development and test of complete systems, this equipment is supplemented as required. From Hydro-Aux's Electronics, Cryogenics and Pneumatics Laboratories.*



HYDRAULIC DIVISION

3000 Whelan Avenue, Burbank, California

Planting: Houston, Ala.; Cincinnati, Ohio; Miami, Fla.; New York, N.Y.; Phoenix, Ariz.; St. Louis, Mo.; Tulsa, Okla.; Wichita, Kan.

## FINANCIAL

### Aerospace Industry Financial Results—1961

These year comparative financial results are shown for major aerospace companies. Those in the aerospace and aerospace equipment categories are only a small portion of those included in the industry, but are shown in an effort to show a useful comparison. Sampling of how sales broke down for various types of systems is shown in accompanying table below. Red figures in parentheses indicate losses.

|                  | SALES<br>(in millions) |       |       | EARNINGS<br>(in millions) |      |      | PROFITS<br>PER SHARE |      |      | BOOKING<br>PER SHARE |       |       | PROFIT MARGIN<br>PER SHARE |      |      | PROFIT MARGIN<br>PER SHARE |      |      |
|------------------|------------------------|-------|-------|---------------------------|------|------|----------------------|------|------|----------------------|-------|-------|----------------------------|------|------|----------------------------|------|------|
|                  | 1991                   | 1990  | 1989  | 1991                      | 1990 | 1989 | 1991                 | 1990 | 1989 | 1991                 | 1990  | 1989  | 1991                       | 1990 | 1989 | 1991                       | 1990 | 1989 |
| <b>AEROSPACE</b> |                        |       |       |                           |      |      |                      |      |      |                      |       |       |                            |      |      |                            |      |      |
| <b>VEHICLES</b>  |                        |       |       |                           |      |      |                      |      |      |                      |       |       |                            |      |      |                            |      |      |
| Bombardier       | 1,000                  | 1,047 | 1,045 | 32.0                      | 35.4 | 37.1 | 4.07                 | 4.61 | 4.90 | 1,040                | 1,040 | 1,040 | 1.00                       | 1.01 | 1.01 | 1.00                       | 1.01 | 1.01 |
| Boeing           | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1.00 | 1.00                       | 1.00 | 1.00 |
| Boeing Aircraft  | 750                    | 710   | 710   | 20.0                      | 19.0 | 19.0 | 2.67                 | 2.67 | 2.67 | 750                  | 710   | 710   | 1.00                       | 1.00 | 1    |                            |      |      |



DE HAVILLAND DH-125, test model of which was rolled out July 25, is designed primarily as a single, efficient aircraft shared between an executive jet transport and a military trainer and administrative liaison aircraft.

## DH-125 Faces U.S., French Competition

By Herbert J. Cohen

London—De Havilland Aircraft, facing intense competition in the world's executive jet market, rolled out its DH125 all-weather transport aircraft July 25, the first of an initial batch of 10.

The airplane has been previously designed for simplicity and robustness. Designers make certain there are no radical innovations in aircraft design and construction methods.

Built as a private venture by de Havilland, at a development cost of several million dollars, the DH125 is being strenuously pushed as a military trainer, business plane and NASA's (North American, North American and North American) trainer, to a number of world air forces. Initial customer probably

will be the Royal Air Force, now pondering the purchase of about 10 airplanes to carry out military transport duties. The deal is believed to be near consummation, with talks down to component parts and placement.

In the field the DH-125 faces heavy competition from the North American T-39 two-seat trainer, which has been shown in Europe. On the other hand de Havilland executives note that, as the test version, its prime competitors will come from the Sud-Orientales Mistris 28 and, they say, this airplane is still in the molding stage.

Major DH-125 features include:  
• **Lowest price of \$469,000** in the standard version and about \$75,000 more for side and side gate.  
• **Large cabin and baggage area** which is what probably will be the main pay-

able executive version, includes a 24 cu ft forward baggage hold, another of 13 cu ft at the rear and six seats.

• **Performance of the Bristol Siddeley Viper turboprop and the engine's extra size** operational experience. However, the Viper Mk. 120 propellers will fly for the first time with the DH-125. This version is a follow-on to the Viper 11 and includes addition of a zero stage and higher temperature rating to produce 1,600 hp thrust (AW May 28, 1965, p. 74). Bristol Siddeley currently is working on upgrading the Mk. 520 (Viper 20) to 3,500 hp and plans to accomplish this month through higher temperatures. Bristol now is in the process of testing the engine and is expected to be contracted by November 1968 for the version.

In view of what de Havilland considers its domestic market, the United States, the company has strongly considered turbine development of the airplane with intention of installing General Electric C1610 engines if customers in doubt, according to Sir Aubrey Burke, de Havilland's chairman. A license line exists between General Electric and Bristol Siddeley, through the latter's acquisition of de Havilland Engines, Ltd., now completely absorbed into Bristol Siddeley.

Sir Aubrey licks the DH-125 has a long future, an airplane based on the airplane's configuration, pace, de Havilland's reputation in the jet and piston field and world-wide sales and service backing capability. So far, de Havilland has built 520 Doves and considers the entire potential enormous although Sir Aubrey complained that the DH-125 is not a Dove replacement. He said

several orders for the DH-125 have at this time been booked.

He said Amazona Where the airplane probably will make its first flight in mid-August to ensure its participation in the annual Society of British Aircraft Constructors Show at Farnborough Sept. 3-10. Airplane must have flown 16 in to qualify for Farnborough showing, but pilot will be Chris Cooper, assisted in the night test by Geoffrey Pike.

Initial project will be certification under Air Registration Board certificate rules, and Sir Aubrey said the airplane will be tested as full transport airplane.

Certification for U.S. requirements will be made under CAR Part 1b, again up to the air transport category. The latter requirement will give de Havilland a competitive edge 2 after get executive planes concentrate on Part 3b, less extensive but with its accompanying restrictions.

At the moment, however, de Havilland is not pushing the DH-125 too strongly as a leader for the obvious reason that it does not believe a market for an airplane in the field is yet a reality. Certification to fall on executive category is more an expression of

company confidence in the airplane's ability to fill a well-defined role.

The DH-125 went onto the drawing board in April, 1961, based on the 50-plus-hour program and has undergone few design changes since that date. Main reason has been landing point and design work on the de Havilland area 161b, a device that used considerable expense in development of the Trident transport transport now flying (AW May 18, p. 187).

When de Havilland first decided to go ahead in the jet executive field, the DH-125 was considerably smaller, with a 43.5 ft. overall length, a wingspan of 44 ft. and a gross weight of 10,000 lb. But market surveys, along with not wanting to build its working drawings, resulted in the slightly larger airplane now being for production. Now length is 47 ft. 5 in., wingspan is 47 ft. and gross weight increased to 10,000 lb.

One result of evolution tests, along with wind tunnel testing of models, was to increase the size of the vertical stabilizer to about 5 ft. to a new height of ground to tip of 16 ft. The move increased downward stability at both high and low speed regimes.

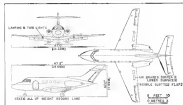
Another design decision was to as-

sume the fuselage 1 ft. to 47 ft. 5 in., to provide the larger forward compartment and to allow the forward passenger door to be opened. First two airplanes will have the narrow door but produce two versions will be built with the larger one. Another feature is that the door opens inward, sliding around the top fuselage on rails. Fasteners are hydraulic and located from a rail.

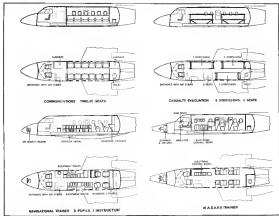
For additional versatility, de Havilland has designed a movable partition behind the forward section which can be fixed to customer specifications.

Airplane itself is built on three sections—nose, center and tail. Wing is built single and fitted to the center fuselage, with the center section joining under the belly and eliminating the need for a main spar to pass through the cabin flooring. Another reason was to increase the useful load storage space, the wing is usually an extra tank, built into five sections to avoid shoring. Fuel is fed directly to two pumps in the center section and fuel control and fuel transfer provisions have been made. The DH-125 carries a total of 1,015 imp gal, or 5,100 lb. of fuel.

de Havilland has not revealed struc-



THREE-VIEW shows engineering design specifications of the DH-125 transport.



SCHEMATIC DRAWINGS indicate various internal configurations of the DH-125 which de Havilland plans to offer.

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level changes in its solitary version although a NASARR transit facility, now a brig built at the Hatfield production plant. This involves considerable stretch in the nose section to hold the scanner and related sensor equipment. Otherwise, the airplane remains virtually the same externally.

### One-Plant Cocktail

Depending on customer request ranges, de Havilland also will offer the airplane in military and civil versions with a one-stop outfit layout.

Wing loading of maximum gross weight is 53.8 lb./sq. ft. and thrust-to-weight ratio at maximum gross is 0.516. Wing is fitted with upper and lower hatches on center sections of each wing and the pilot is provided with an ejection control on the main console.

The Havilland is predicting D91-E25 overall performance on a standard operating speed ( $V_{10}$ ) of 290 kt below 25,000 ft. Above this altitude, speed will be about 0.75% above the

Maximum gross weight is 18,000 lb, and landing weight is 17,500 lb. In current configuration with payload computed at 1,400 lb, the visual flight rule range would be 2,800 naut. mi., based on long-range cruise at 36,000 ft. and fuel reserve for 45 min.

Weight breakdown, using the current system, is structure, 4,390 lb., two Viper SEs, 1,500 lb., fuel system, 798 lb., sensors, 1,447 lb., safety devices,

including wing provisions, 152 lb.; instruments, including main compass 34 lb.; furnishings of cockpit, cabin and toilet, 485 lb.; and passenger seats, 160 lb., for a total empty weight of 8,000 lb. Optional items, such as radios and outside wall stanchions would bring empty weight another 550 lb.

### Permutation Systems

An overconditioning is automatic and controls are operated by the copilot. Sea level pressure can be maintained to 21,000 ft., and at the maximum operating height of 35,000 ft., the cabin pressure will be at least under 7,000 ft.

The company's target date for introduction is mid-1983, with deliveries following in the last quarter of that year. Main production will be concentrated at Hawarden Airport, near Chester, although the prototypes are built at Hatfield, site of the Trident and Conquest production lines. A second prototype, now well advanced and with wings mated to main fuselage, is scheduled to fly in October.

The first airplane will be used exclusively for certification testing. Second prototype will be used to build up the engine time on the Viper 570 and possibly will be based at Bristol Siddley's Filton plant.

## Israel Aircraft Considers Private Financing for B-101C Development

By Arnold Sherrman

New York-based Aircraft Industries Ltd., of Lod, Israel, will receive development of the B-101C turbojet executive aircraft this year, according to an official of the company.

Staff international competition in the executive plane market, plus lack of anticipated regulations for the project, led to abandonment of original development plans (ENR Oct. 9, p. 26). General

configuration of the aircraft, a prototype mockup of which was on display at Israel's Lod Airport facility (AVF Apr. 12, 1963, p. 185), will doubtlessly undergo some modification, but the basic design will probably remain the same, except

Israel Aircraft management decided to cancel development of the test to commence transport last December. At this

time for the company, created that the reason for the cancellation was that design changes were needed in order to permit the aircraft to compete more effectively in the world market by increasing the powered range and speed of the plane.

The PD-805, the SAAC 73 and the D01-825 were all aimed at the same market. Tight governmental price controls added to the dilemma.

Basic reason behind resumption of the plant's development, according to Tarr, is that the company is now considering greater investments to complete government funds. The firm was organized as a government-owned and controlled corporation, but a public firm

can budget plus studies indicating that a private investment potential exists both on a domestic and international level, have heightened private investment interest. Undoubtedly, an appreciable amount of the expected funds would come from American investors. According to Yary, research has indicated that the potential and interest both exist.

In addition to its design work on the Y2000, Israel Aircraft is expanding its groundhandling equipment manufacturing facilities with an overseas export. The firm has negotiated an agreement with the C-SP company in France to manufacture aircraft electronic equipment, a production for Puma Air Force CM100 Mirage fighters for the Israeli as well as countries in US and European regions, providing overhaul and maintenance work for the air bases in Portugal, France, Comoros and Beirut. Israel Aircraft also handles the maintenance work for Air France, TWA, BOAC, BUA,

Alchidi, Samson and Clement Amwari

Major facility enlargements and increased aircraft handling accommodations are planned by the firm which now employs 3,300 people. The main shop area is to be expanded and the construction of an additional large hangar to handle added aircraft overhaul work is projected. The engine shop will be expanded to facilitate handling of France's Snecoma Atlas 9 and Rolls-Royce Conway engines.

In line with the firm's growth, steel and potential Israel has sent Yarn to the United States to recruit the technical and professional personnel which, according to the Israeli executive, are lacking domestically.

Every mid-level level spends roughly 10% of its overall budget on technical training for its personnel but despite this a critical shortage of skills continues.

Part of the problem appears to be that a significant percentage of the newly arrived hermits are from African countries and few of these immigrants enter Israel with any technical or professional specialties.

Yare said that lack of technically capable personnel has been a prime factor in the growth of the company. "If it is at all possible," Yare said, "we

United to recruit the personnel we need in the United States, Canada and Europe." Ferry said that to date "considerable interest has been shown by the American engineers he has contacted."

• **Improved relations with African and Asian nations:** Israel is making an intense effort to cultivate the friendships of the newly emerging nations in Africa and Asia. Yancy pointed out that while at the moment there is very little business potential for his firm in these nations, his country anticipates that as these countries progress, technologically and economically, Israel's geography and competitive cost factor will stand it in good stead.

**Peace with the Arabs.** Yare stresses that as far back as 1991, a year before the official creation of Israel Aircraft Industries, company growth was related to eventual peace with the still hostile Arab nations. "We are realistic enough to admit that Arab challenges, the economic constraints imposed upon us and the denial of political and maintenance work by our closest neighbors, has an undeniable effect on our growth. When a lasting Middle East peace, a rebirth of the growth potential of the company will increase immeasurably."

## Private Aircraft Sales Show Spotty Rise

By Kevin L. Hoffman

**Dallas, Tex.**—Business aircraft industry's experience in the first half of 1962 under 1962 basic rate surtax indication (AWW Mar. 12, p. 237) that total deliveries and total dollar volumes are likely to exceed those of last year, but the situation presently looks apathy for some companies and all else not there in the meantime.

All indicators point towards Ceres leading the field this year in units delivered and dollar volume by a healthy margin. Borch and Ara Cosensaw are less optimistic. First they were earlier than last year and Mazon is showing increases in both units delivered and dollar volume.

Part of the sluggishness is attributed by some commentators to the Administration's so-called tough attitude towards business and part to the recent sharp decline in the stock market. The latter they say, has not only reduced consumer interest, but also put a damper on some distributors who suffered paper losses in the plummeting market and who fear that their capital position is such that they should curtail operations.

As a result, factory personnel that were not working hard with field sales could let saying their distribution and delivery to take advantage of any income created by the competition's slow down in efforts, while those experiencing a decline are not trying to prevent the loss of business.

Most optimistic of the big companies is Cessna. Marketing Director Manager Fred Martin feels that the company will do at least 10% better in dollar volume this year than last, with factors helping meaning \$4-5% revenue higher. Although he said American West that he thinks units delivered might only be a fraction higher than last year, indications are that if the company's rate of sales continues at the pace shown so far, Cessna will have a

Vacuum production rises to meet retailers' demands for new axles.

Martin noted that although all figures have not yet been fully tallied, it appears that through June of this year, Cerasa will have accounted for approximately 48% of nests delivered by what it considers the major companies—Aero Commander, Beech, Cessna, Mooney and Piper.

Tallentire says, May's estimate that Cosma had delivered 322.5 million retail sales, in single-engine business planes, accounting for 78.6% of the market to the multi-engine market, the converse, is the same period, grew and 24.4% of the total business, accounting for 55.5 million in sales. In both areas, according to Cosma, those totals exceed those of the same period last year, with its percentages of dollar volume being up more than four points in the single-engine type and back to its multi-engine airplanes, for an increase of 54.4 million and nearly \$7 million, respectively.

Broch reports total business plane sales will be about the same as last year, although that fits its business line being down about 5.5%. Factory units for executives are being sent out on the deal to show that the company is not just a dealer and poses them to lower sales volume with plane orders with the brokers, for demonstration. Broch plans to field executives are down substantially—actually far less than they should be—with the result that this is a subject of considerable concern at the factory.

These favorable notes in that airplane are not a bad thing, but they are a step up and demonstrating the kind way rather than taking through a brochure with him. As Frank Hedrick, Broch executive vice president, put it:

Some dealers still want to be the business

Booth is working hard to enlarge its distributor/dealer organization, but a major bottleneck exists in this field be-

cause of the lack of experienced sales personnel. It hopes to accelerate the process with introduction of its new four-place \$13,900 Markster; this fall, which because of its price should enable new dealers to join the Borch organization that have been unable to come on business of the cost of conversion parts at the company's higher priced line. The company, in fact, is planning a major promotion campaign headed around the Markster, aimed at potential dealer prospects.

[illegible]

The industry, generally, is making continued gains in exports, although business probably will not show the same rate of increase in the past year. Changes in this area are not due so much to a decrease in interest on the part of customers as the constant change in geographic market patterns—what was a good market one year, suddenly becomes a poor one the next because of changing dollar exchange problems and local political situations.

Jack Wood, Cassin report manager, reports that generally the company's international business in the first five months of this year took better than \$6.5 million compared with just under \$4.5 million the same period last year and that divisions projected delivery of 62 units in June '83 to 14 ahead of the same time last year. Sales of two-engine aircraft are up markedly, with 41 sold in the first half of 1982 compared with only 9 last year in this period.

The new pump capacity translates to be good again in the European market this year, particularly since it has good demonstrator representation in that area. It has 310G or 300knight from available in France, Denmark, Sweden, Italy, Germany, Norway and Sweden and this month participated in a cruise showing in its Swedish distributor, Solberg Group P&A AB, in Stockholm. The distributor purchased 15 acres of pumps for other dealers and currently at 5,000 units.

### South American Market

In the South American market, the political situation has allowed operations somewhat, although Zook believes it is probable it will not in 1981. In Brazil and Mexico, which appeared to be the most promising markets in the south more recently, and he expects sales in these two countries to be up 15-20% over 1980. Absent market apogees favorable in 1982 and China has been the most important market in Australia should then a 10% increase. New Zealand seems on the verge of losing local dollar transactions and most of this country has been closed to exports for a long time. The Japanese market is high. The Philippines seems are looking up—Cuma said a 318G demonstrates into Manila early this year and the distribution there already has taken on a new dimension. The export of oil is closed under the flag of the company.

Breco also reports export gains—business owners expected to be up 4 to 10%—pending net billings of \$17 million in 1982—with major activity in Europe, the Middle and Far East. South America has tapered off. Largest percentage increase of foreign business plans sales is expected to occur in the Far East area.

The company has arranged its European representation—taking care of three distribution in the Scandinavian, Belgian and Austrian areas and making them dealerships under Travel Air GmbH, Bremen, Germany, and extending Travel Air's territories to cover France, Italy and North Africa.

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### JetStar Demonstrated at Reading Air Show

Lockford jetties occurs lowest fly in at the Reading, Pa., Air Show. More than 600 aircraft ranging in size from early Piper Cubs to Fairchild F27s circled the airport's grass parking area during the event.

## Antonov Criticizes Soviet 'Quota' System

[Soviet aircraft designer G. K. Antonov has emerged in the last year as a leading spokesman for improvements in the over-all Soviet industrial atmosphere—especially in regard to quality. His comments on two separate articles in *Aviation Week and Space Technology* (see pages 14 and 15) are being widely reprinted in Soviet newspapers. Key excerpts from the articles follow, and the box on page 75 deals with an other Antonov criticism, the one concerning work on Soviet astronautical engineering collection.]

What should make Soviet men work—and work well? It seems to me that all standards—both moral and material—should, on the basis of first efforts, be directed into the same groups.

The most important strength must, in my opinion, reside in the first group. This is the purely moral standards—the growing ideological consciousness of Soviet men, his desire to serve society the most need to work which can on could realize his dreams, lead into him. In the second group of standards I would place discipline, the feeling of responsibility, the desire to fulfill the plan, schedule or instructions of one's superiors, compliance or of an organization's higher management.

## Self-interest

In the third group of standards one should place direct material self-interest as determined by piece-rate wages or a progressive wage scale, a premium system, or other forms of encouragement. Standards of the last group operate correctly and unambiguously in accordance with the interests of society because they are regulated by an understanding of these interests. But, unfortunately, one can't in every instance use the same about standards in the second and third groups. These standards are not controlled in character.

The extent for plan fulfillment and the methods used in determining external reward for work can sometimes lead to entirely unexpected results when there is a poor choice of control "incentives." Such faulty "incentives" make some people act against their own interests, and, in some degree, even against the interests of society as a whole.

These "incentives" encourage people

to be wasteful, to neglect as an economical attitude toward socialist property, and to expend working time and materials heedlessly.

Recently I was walking along Moscow's Belorusskaya Moshkovskaya. I stepped over a track from which two female girls were walking bricks for construction of an apartment house. Actually the term "walked" is hardly accurate in this case.

They simply threw the bricks on the ground in a huge, disorderly pile. I estimated that about 30% of the bricks were broken in this process.

## Overimplified instructions

This happened because the workers' instructions were overimplified. They were just told to unload the truck as fast as possible. Probably the girls were paid by the hour while the truck driver was paid a wage plus a bonus per ton of bricks loaded or, possibly, according to the number of kilowatts he drew each day. In addition they were all probably told to hurry so as to fulfill the "plan."

In all these cases work was evaluated by some sort of abstract metrics that are divorced from the realities of life and from the ultimate usefulness of the task in hand.

If these two girls had been paid on

the basis of each 1,000 undamaged bricks delivered to the construction project it can be almost confidently that the breakage would have been cut by at least two thirds. This undoubtedly would have presented a considerable saving since for both the girls and the driver, would have provided the project with a better supply of building materials, and would have allowed the risks to save money.

But why is this not being done? It would mean that a girl or worker like them, the first of the worker in that case, including of the bricks would be given more time. The truck would be standing still, let's say, half an hour, not ten minutes, during unloading. This would mean that the brick driver would, for example, make only five trips daily instead of six. This would quickly affect his wages. Secondly, he may not be free from difficulties—the work index of the truck pool, the decrease (4) because the number of two loaded and the number of two broken trucks would be reduced. Therefore, it is more "profitable" for the truck pool to load or break bricks even though 50% of them are up and broken, than to load five loads with 10% losses.

Is this possible? An elementary mathematical calculation provides the answer to this question.

One "truck" trip back to the construction project brings only 70% of the whole brick load at the factory. Multiply 0.7 by the specific number of trips—and you get 4.2 truck loads a day. This is the number of whole bricks actually delivered to the construction project.

## Alternative Cited

Now assume that the girls carefully pile the bricks in a neat pile and the breakage is reduced to 10%. Multiply 0.9 by five trips and you get 4.5 truck loads of whole bricks. As far as the remainder of good bricks is concerned. In addition, an entire truck load of bricks will remain at the brick plant. So, things will also be saved in truck fuel and depreciation, making it possible to increase the wages of both the girl workers and the truck driver.

Is this sort of work organization reasonable? Yes, it is. But the trouble is that such reasonable methods for organizing various types of production activities, while clearly beneficial to society as a whole, sometimes lead to a reduction in "gross output" and, consequently, to

an apparent drop in the work output.

This is what is in many cases that prevents the State Planning Commission, economic councils and individual plants from shifting over to new and more progressive indexes which obviously would suggest a judicious scale and an incentive for men to move forward toward socialism. Thus, an economic council would have to explain to the regional State Planning Commission why output dropped suddenly. The regional State Planning Commission would, in turn, have to explain to the USSR's State Planning Commission, etc., etc.

The situation sometimes the same with regard to imposing product quality. It happens that one man makes quality and you demand output. And even though the increased quality is very profitable to the state, a plant will, with the blessing of the economic council, stop for good output. Undoubtedly, good output is still one of the main indexes of plan fulfillment and the plant is a matter of honor for the plant's employees and directors. What's more, the plant's personnel have, as a rule, a national conscience, the existing human sense of the national good output index.

Let us take a simple example.

▲A factory makes aircraft engines which can operate 1,500 hrs. before one plan reinspection.

▲Maintenance required to make an engine with a service life of 5,000 hrs. would require not twice as much, but only 20% more resources of labor.

Even so, despite the obvious advantage of making a better quality product one economic council and an aircraft engine factory will do that on its own initiative. Given output, you see would fall by the same 20%.

There is only one way to eliminate that contradiction, and that is to change over to new, more progressive methods for evaluating a factory's work. After all, what is important is not the number of engines built—built by itself and unaided from their quality and service life—but the total number of hours they will operate in the airplanes.

If a factory's work is evaluated according to service hours, then the changeover to a new and more labor-consuming type of engine would be profitable not only to the state as a whole but also to the factory manufacturing the engine.

In addition, we assume that a factory makes a 5,000-hr. airplane engine per year, then their total service life will be 1,500 times 5,000, or 1,500,000 man-hours.

Suppose, now, that the factory changes over to the new engine having a 3,000-hr. service life but also requiring 20% more man-hours to build. In this instance, the engines produced

## 'Book Learning' Engineers

(Reminds me somewhat on industrial efficiency.) Soviet designer G. K. Antonov also has spoken out against some forms of Soviet astronautical engineering education. A large part of his comments follows.)

There was no serious criticism in the city where I completed secondary school. I had to enroll in the university's railroad and highway department so that in the future, I would get the chance to move closer to aviation. However, the railroad and highway department was very interesting. For two years I had to enroll in other universities—it was more difficult than then now. In the meantime, some friends and I built a glider on our own and took it to the All Union Glider Meet at Khabarovsk. Thus, on our own initiative, we first had to acquire an understanding of aerodynamic strength and aerodynamics and then had to learn to be engineers and technicians.

When when I was studying at the Leningrad Polytechnical Institute one student group managed to build five more gliders at various design. As a result, I really passed special subjects without preparing lessons. On the other hand, I was "troubled" by the course on electricity theory, which I didn't learn. This simply cannot be done under the present, hurriedly educational system in our universities. And so it went. We studied what was necessary and at the same time we mastered some practical skills. But now, this is almost impossible for students to build not only a glider but even simpler structure. Doesn't this lack of opportunity to engage to creative labor because of the enormous academic overhead result in technicians-type students who become technicians for one reason?

There are very capable teachers, especially in the design of technical studies, going to build small, simple airplanes of their own design? How the college authorities avoid charges of material reasons why such a project should not be undertaken. Won't a student with teacher? Who will be responsible if there is an accident? And so on, and so forth.

But this is not many years of experience, I assure you, it won't interfere with students' work. They must be given the message and support they need of constructive criticism in their studies. We must not shut their wings but strengthen them. Building even a small technical structure by their own efforts will provide them experience with experience and showing that cannot be replaced by our load of "points" at a plant, in specially organized workshops or departments. It will provide skill in reasoning, knowledge, and the opportunity to obtain on even all first-hand understanding—a proper source of a wide range of complex problems. Construction of a light airplane in college workshops doesn't cost less. It is 10 to 20 times less expensive than when ordered at a factory. And a glider would cost still less. Furthermore, such construction can be considered as all or parts with the college programs, with laboratory work, and with our own work.

The Khabarovsk Airfield is one of the most advanced in the nation. But even there they have hampered flight tests of a light plane built by students. As a result the student designers, although having known how to fly, decided to test for airplane themselves. It was disastrous. The teacher design and his friends built a simple airplane. The team he suggested it did not the windings of right hand and it did at the height of a house. And, of course, the result was a loss. They must make careful the tests which have been at the Institute had taken a more serious path for the first, of those who knew about the project had not been afraid of what the director would say, and if they had not put a spoke in the wheels.

As for the attempt to prevent our students from studying abroad because of the danger of "spies" persons who are working abroad, we must not be afraid for this. And to 1918, Americans in all parts of the country built two of gliders and airplanes. Americans were very intelligent, and even their best men nearly always, instead of receiving help and cooperation, the technicians were kidnapped in their work and had numerous demands put in their way. Sometimes there are even made small studies themselves. We have become much more independent and advanced. Why, then, do we use all of initiative and technical creativity? If a college is unable to guarantee the stability, responsibility and structural strength of a man anytime or glider built in its workshops, then how can it graduate so technical engineers?

The problem must be put more broadly. Students must build not only airplanes and gliders but also automobiles, aircrafts, helicopter tanks, rockets, calculating machines, radio equipment, small engines, and many other things.

If we help students in the right way to prepare themselves for creative work, I believe that the number of technicians who have been "paid" tests will decline sharply. And the number of people who love their work personally will be paid a sufficient number of technicians. We will then become simply responsible to evaluate a student's "success" as his grades show.



G. K. ANTONOV

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Designed for reliability and flexibility at temperatures ranging from -45° to 450° F., Stratoflex Super-T medium pressure Teflon hose and Super T-HP high pressure Teflon hose exceed the rigid requirements of MIL-H-25579 and MIL-H-8798 (ARP 604) respectively. The stainless steel braided cover hose and inner tube of Teflon has an operating range of 1500 PSI to 3000 PSI and is unaffected by all fuels or synthetic base lubricants, acids, solvents, alcohols and coolants. Non inflammable.



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STRATOFLEX is a Division of a company which is a subsidiary of a firm which has plants in 100 countries. It is a leader in the world of hose and fittings. It is a leader in the world of hose and fittings. It is a leader in the world of hose and fittings.

COMMERCIAL AND MILITARY  
MANUFACTURERS SPECIFY  
STRATOFLEX SUPER T-HP  
HOSE FOR THE MOST  
CRITICAL APPLICATIONS



## First Mystere 20 Flight Set For 1963

French Dassault Mystere 20 two-seat home and overseas transport will make its first flight sometime in 1963. Almost 400,000 sq ft, it is powered by two Pratt & Whitney JT12-A-6 engines equipped with thrust reversers.

annually by the factory with the same number of even lower tolls for 1,000 units, 1,000 divided by 11, or 2,500 units less.

This is equivalent to increasing engine output by 67%. It would put plants equipped with these engines either to increase flying time by this amount or, at less than a 67% increase in flying time is planned, it would permit the factory to reduce engine output, thus saving a great deal of labor and materials.

The number of examples could be multiplied. But one must note a very important circumstance which is frequently overlooked. Inaccurate and incorrect factory work makes not only losses for the national economy but also creates conflict between high social standards on the one hand and the demands for plant facilities and material adjustment on the other.

In the second article, Anderson took notice of the many comments received on the initial one. He continued:

As was noted in most of these comments, the reason for many of the shortcomings in the work of our plants is the imperfection—the frailties—of production planning.

What, indeed, is it that, for example, makes a factory in Japan able to seek to produce as much as possible of any kind of metal and at any price instead of turning out more high-quality metal at maximum expense? What is it that, as a rule, makes builders put up buildings under conditions of primitive tools, and only when they are unable to do the proper? Everyone knows that besides being backward, such a work requires makes construction a waste of resources and damages the nation's interests. Why are the results of a worker's labor evaluated according to the number of units made rather than according to the total amount of useful work those units can perform? Why is it that at the Upper Silesian factory for the production of new cars that considerably

exceeds the speed and raises the cost of driving is regarded as "unreliable" for the factory? Finally, why does the same factory at Chelabinsk discharge a super solution into the river in order to fulfill the "indicators" established by the plan? Why is it that losses today are being added to cost when it only lowers the net's quality?

All these and other such "where" lead down to the same thing—the losses which it does to our production when we evaluate the results of labor by quantity and not by quality.

In their letters, the readers of "Economic" have cited striking examples of how the plant managers, in order to fulfill the "indicators," are forced to expend unnecessary labor, materials and machine-hours while, at the same time, delivering products which are not the best.

What is better for the state to produce two automatic looms which make 10 million pieces annually or five looms that make just as many pieces? Obviously it is more advantageous to build fewer but more productive looms. However, in reality, it would not like this you make five looms—even though they are twice as productive—and it means you haven't finished your plan. So it is worthwhile to risk to perfect the design of an automatic loom.

The prevailing "risk output" system of industry does it. For example, encourage a ball bearing factory to work hard to increase output like the bearings. If the number of the bearings were doubled, the demand for their bearings would be cut almost in half. That would be very good for the national economy, but finally the factory is not interested in the benefits the plan of the bearings is not tied to their output.

It must, unfortunately, be stated that part of the existing system of indicators used in our industry to decrease the facilities of plants in many factories may eventually be removed from the political economy of the capitalist

system. Very few of us are engaged in research into new, socialist strategies toward production which have originated in our country.

The capitalist is interested in indices which determine future profit. He is not concerned with the national welfare. Therefore, gross output is also a suitable index for him, since it is closely associated with revenues obtained from the products being sold. But for us, gross output is not the principal index. It can be regarded only as a secondary index—and even then with reservations. Some district economic councils have based on gross output as their principal output; they have begun to extend production of simple items, which formerly were manufactured at one factory, to two or three factories. Each factory along the line has the unfinished product from the previous factory, adds something to it, sells it at the next factory. As a result, gross output doubles or triples.

A factory director told how many men of parts and components are left in the warehouses of some plants. When? Because in the first place, the plant director does not trust the operating efficiency of the supply network and, in the second place, because, when he feels himself as a tough operator and he is in danger of being to meet his plan, he can take various parts and components from the warehouses in somewhat larger numbers, but then in production, and the plan for gross output will be fulfilled.

And what real advantage does the national economy get from this poor system for measurement? Inflated figures, a waste of time in avoiding using storage terms.

Under conditions in our socialist economy, indices for monitoring and evaluating the results of a plant's work must be set up in such a way as to reflect both the managers and all of the plant's personnel to achieve the maximum national advantage. The principal work

# INTERNATIONAL AIR TRANSPORTATION ISSUE SEPTEMBER 10, 1962

The impact and challenge of recent trends and developments in international air transportation will be the subject of AVIATION WEEK & SPACE TECHNOLOGY's International Air Transportation Issue, September 10, 1962.

This major editorial effort will analyze the direction and problems associated with the growth and expansion of air transportation in all major world markets including Atlantic, Europe, South America, Africa and Asia.

Subjects slated for special emphasis are: Development of a new U.S. international air policy; World-wide impact of common market and African confederations; New flag carriers of emerging nations; New trends in supersonic transport research; Communist bloc penetration in world air markets; 1962 traffic trends; and future international tariff and merger problems.

Copies of this issue will be distributed to delegates at the opening session of the International Air Transportation Association (IATA) Conference in Dublin, Ireland. Here will be gathered the international leaders of air transportation whose attention and discussions will be focused on these and other major issues.

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index of each plant must be the national benefit, the effect on the national economy, which seems to be the rule as an overall basis when the production of a new factory is considered.

To do this, it is necessary to measure quantitatively the categories of quantity and quality. In such case, the conclusion seems to produce a little waste by reducing the product's quality will probably disappear.

The logical connection between quantity and quality must be such that when changing over the manufacture of higher quality products, even if made in somewhat smaller quantities, we necessarily will achieve growth in both quality and quantity of production in the national economy as a whole.

## Reciprocal Connection

Economists must see clearly that under old social and economic structures, which developed quantitatively over a long period of time, a so-called reciprocal connection inevitably existed. Without this connection these two very structures simply could not exist.

Thus, for example, in the system of capitalist production, the rule of reciprocal connection is placed in selling, by the market and by competition. It is these factors that leave the capitalist to make things better, more dependable and cheaper.

Under our socialist conditions—in an economic system built by society according to the laws of reason—the reciprocal connection must also be created through reason. This must be well thought out and must be in the required sequence.

The textile industry not only is not suffering but, in the opinion, is flourishing. (4) export of fabrics which have had no market for a long time. Such conditions are possible only because a reciprocal economic connection is completely missing here. The textile factory does not know its market and is not interested in the selling of its products. It turns over the fabric to the marketing organization and doesn't give a hang about marketing it. The State Bank hands out money to the factory for wages, for procurement of raw materials, and for other expenses. And so it is possible to keep on working not for the sales consumer but for the consumer.

That is why the marketers sometimes are hesitating with goods consisting of millions of rubles which have no market. This is why some establishments cannot obtain necessary articles, tools, machines and semi-finished materials from their suppliers and the consumer cannot obtain clothing and shoes in the latest styles and colors.

The efficiency of consumers in their suppliers and on their production plan is extremely limited in our economy.



**Vibration Dampers Installed on F-27F**

Vibration dampers, designed and installed by Horton Electric and Electronics of Ft. Worth, Tex., are now aboard Fairchild F-27F. A total of 72 dampers, consisting of simple boxes with two top corners, are installed at various points around the main fuselage frame.

Yet the nation-wide planning organizations and those in each Soviet republic are unable to plan the work of such factories in harmony with all the rest of the factories. This is a task that is still beyond their power to solve.

The existing methods of planning factories lead to pervert of the basic factors of the plan and this inevitably leads to a situation where we borrow from tomorrow. These figures are, as a rule achieved by ad-hoc affecting the work of other establishments which are the recipients of products in future years. The figures are not by having the work of a factory as a whole and by getting into the output of future years. Examples of such borrowing from the future is the pursuit of a plan for selling kerosene for gasoline. Oil fuels is the result of economic work with regard to agriculture.

The changeover to computing the work of industry by new, more progressive and more complex indices which

take the national welfare into consideration can be carried out without harming general interests applicable to the national economy as a whole. After all, we have stopped creating our future output in terms of irreproducible, disposable without discussion consumption.

The work manner is one reference which are not being used because of automatically translated and obsolete (1) obstacles inherent for counting and evaluating the work of industrial plants are excessive. We can cite this example brought to mind by General Sherman of Louisiana.

In manufacturing paper as cardboard, there is a reference which permits a variance in one direction or the other from the specified thickness. The results of the work at the paper-making plants are evaluated according to the weight of the product. Therefore, the paper makers tend to try to select the lightest paper in order to make the paper a bit thicker and, consequently, a little heavier as well. This new materials are expended wastefully and above zero.

That a single calculation shows that if the upper tolerance is eliminated (modern technology makes that possible) the using in the material be put into paper-making machine of average productivity will permit the manufacture of 3,000,000 square meters of paper annually above the usual. We would utilize use of these reserves and provide an outlet for the forest being idle in our economy.

The use of new and progressive re-

## Pert/Cost Handbook

Washington-Handbook describing new standardized PERT/Cost procedures recently adopted by Defense Department and the National Association and Space Administration (NASW June 21 p. 10), is expected to be available from the Government Printing Office in Washington on or about July 25. Price has not yet been set. Approximately 15,000 copies are being printed in anticipation of widespread demand.



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Do not send if you are not an engineer.

#### PROBLEMATICAL RECREATIONS 128



Six grocers in a town each sell a different brand of tea in four ounce packets at 25 cents per packet. One of the grocers gives short weight, each packet of his brand weighing only 3 1/2 ounces. If I use one of his brand for only one weighing, what is the maximum amount I must spend to be sure of finding the grocer who gives short weight?

—Charles Wolf

If you're a specialist in digital systems integration, make no time getting to your Data Systems Division. Possibilities of responsibility are open for engineers who know design with one hand, hardware with the other, and can see that they both move as a smoothly functioning digital control data system. If busy at your keyboard, join My Heavy D. Let us call.

**ANSWER TO LAST WEEK'S PROBLEM:** The rightmost digit of 7<sup>n</sup> is 1, 7, 9 or 3 according as  $n \equiv 0, 1, 2, \text{ or } 3 \pmod{4}$ . Since 7<sup>10</sup>  $\equiv 7 \pmod{4}$ , the rightmost digit of 7<sup>10</sup> is 7.

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them of a socialist type should still begin at only certain plants. Then the reform should be extended gradually to industrial companies, branches of industry, and to entire distinct economic councils.

Broadening the prerogatives of plant directors and managers is an enormous task. Hence it is difficult to expect important progress until the broadening of prerogatives is accompanied simultaneously for all management and in equal measure—that is, according to the least indigenous or class principle. Such all-encompassing action forces the socialist and most incredible managers to convert themselves.

#### Director Categories

It seems to me that it would be advisable to change over to a system of categories or classes of directors. A director of the second class should have more prerogatives than a director of the third class. A director of the first class, being among the most able, energetic and experienced managers, should also have the broadest prerogatives, thus enabling him to strive for product output at the highest quality at the least cost. His prerogatives would include direct agreements with work customers—agreements made with both public supervision in the district economic council.

With such an increase in prerogatives to the extent of each manager's ability, the district economic councils will be subject of considerable responsibility, retaining only the most general control as a matter of course. But the plant directors will be to work the best for know how in order to meet confidence, at the same time, in order to achieve a higher class and greater trade preference.

#### Company Stores

In the field of manufacturing and selling consumer goods, this would lead to the appearance of a broad network of firms having their own stores. The director would be kept essentially in financial control the demand for goods produced in his plant. When the goods are available, he make more of them. When the people have little and nothing, he either make improvements to change over to another model. Other wise, we find yourself left high and dry.

Such a system would not provide the substance of large marketing apparatus from operating as socialist cooperation with plants engaged in the direct sale of their products through their own factory stores.

The ill-fated reform of our production system are enormous. Putting these matters at the service of the national economy is the task that N. S. Khrushchev [has] set forth. . . .

## WHO'S WHERE

(Continued from page 15)

#### Changes

**Dr. R. Peter Lounsbury**, assistant general manager, Aerospace Corp.'s Engineering Division, Los Angeles, Calif. Also **Robert P. Lounsbury**, assistant to general manager and vice president, Aerospace Corp., White Plains, N. Y. **Flight Test Office**, which will be located at the Air Force Missile Development Center, Huntsville, Ala. N. Y.

**WFO Inc.** has appointed **Robert J. Jackson** as assistant chief, vice president, Air Force Missile Development Center, Huntsville, Ala. Also **Robert J. Jackson**, chief, vice president, Wright Aircraft Development Division, Dayton, Wright Corp., Dayton, Ohio. N. Y.

**Dr. Victor Tuller**, director of research and development, Convair Division, Dayton, Ohio. N. Y.

**Elmer E. Jones, Jr.**, assistant to the president, Trans World Airlines, Inc. Also **John F. Murphy**, director of staff and operations.

**Carl A. Coffey**, director, Aeromedical Problems Group, Robertshaw-Petersen, Incorporated and Instrument Division, Aeromed, Calif.

**Wesley M. Worley**, general manager of General Electric Co.'s Phoenix (Ariz.) Division.

**John A. Scherer**, manager, Advanced Systems Section, Sales Development, Hercules Fluids Co.'s Chemical Products Division, Wilmington, Del.

**Don A. Drake**, vice president, manager, General Electric Co.'s Chemical Products Division, Wilmington, Del.

**Dr. James Franklin Sartin**, director of research, Lockheed Georgia Co., Marietta, Ga.

**Joseph L. Zepherinus**, head of the research department, Langley Research Center, Langley Research Center, Hampton, Va.

**Robert A. Blum**, director of public relations, Lockheed Propulsion Co., Burbank, Calif.

**General Dynamics/Reynolds**, San Diego, Calif., has announced the following appointments: **James H. Reynolds**, vice president of operations; **Dr. D. S. S. S.**, assistant to the general manager; **John W. S.**, chief engineer, product planning product group.

**Dr. George F. Mueller**, chief, Applied Research Section, Research and Development Department, General Electric Co., Los Angeles, Calif.

**Dr. Robert L. Carlson**, director of Spacecraft Weapon Systems, Aerospace Division of Ford Motor Co., Detroit, Mich. N. Y.

**Dr. Robert L. Carlson**, director of Spacecraft Weapon Systems, Aerospace Division of Ford Motor Co., Detroit, Mich. N. Y.

(Continued on page 11)

## We're looking for men who can't let well enough alone



Northrop doesn't need men who ask questions; men who don't ask to ask the boss. In the advanced areas we're exploring at Northrop, you don't dare take anything for granted. If this kind of challenge appeals to you, put down the magazine now, while it's on your mind, and write us a letter. Positions are immediately available for:

**Engineers** in electronic, analog systems who have worked with advanced design and program development.

**Engineers** whose background is in supersonic aerodynamics, stability and control, inlet design, ducting, and performance analysis.

**Engineers** familiar with infrared structural analysis.

**Scientists** whose line is infrared, optics, and electronic research.

**Engineers** to work in noise reduction.

**Scientists** who know structural research and dynamics.

**Scientists** who have done supersonic aerodynamic research.

**Scientists** experienced in working with information and sensing systems, platforms, infrared, sensors, flight controls, onboard computing, and data handling systems.

**Engineers** familiar with programming operations, and instrumentation for solid state missile flight test.

**Reliability Engineers** to assess the reliability and to optimize the configurations and mission profiles of space systems.

**Chemical Engineers** to work on the development and applications of structural adhesives for aerospace vehicles.

**Methodical Engineers** for research and development in materials and joining. If you'd like more information about these opportunities and others that may be available by the time you read this, write and tell us about yourself. Contact: Roy L. Paul, Engineering Center Personnel Office, **NORTHROP**, 1001 East Broadway, Hawthorne, California. An Equal Opportunity Employer.



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Resumes should be sent to Mr. Martin.

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## WHO'S WHERE

(Continued from page 11)

**Walter E. Berlin**, chief, Airport Traffic Control, lives at the Federal Aviation Agency's new Dulles International Airport.

**W. R. J. Kuch**, general manager, Aircraft and Control Products Section at General Electric Co., Eagle Village Electronics Department, Johnson City, N.Y., moved on May 18, 1968 (AM June 25, p. 12).

**John K. Culler**, supervisor of customer representatives, Westinghouse Electric Corp.'s Systems Management Department, Baltimore, Md.

**Dr. John E. Frenkel** has moved the Technical Staff of National Engineering Science Co., Pasadena, Calif., and Dr. Roger Walter has moved the Boston Staff.

**Raymond W. Fish**, director of quality control, Electronics Operations, Avco Corp.'s Electronics and Ordnance Division, Fort Belknap, Ohio.

**Garold Skala**, chief systems engineer, and **Robert Linder**, chief systems engineer, Western Instruments Division, Chatsworth, Calif., moved to New York, N.Y.

**Dr. Gerald L. Zimmerman** has joined the Douglas Aircraft and Space Systems Division, Santa Monica, Calif., as assistant to the Division vice president-director of product development.

**Col. David B. Offutt** has replaced Col. Charles A. Brown, retired, as Air Force Flight Test Center information chief, Edwards AFB, Calif.

**Alfred E. Nowens**, director of design, American Airlines, Inc., succeeded Karl S. Ditt, retired.

**Charles F. Thomas** managed staff marketing, International Defense Programs, Ridge Corp. of America's Defense Electronics Products Division, N.Y.

**C. A. Smith**, manager of technical liaison, Electronics Defense Laboratories of Science Electric Products, Inc., Mountain View, Calif., and **Lawrence M. Johnson**, manager of technical publications.

**Alvin W. Markel**, chief electronics engineer, Bell Helicopters Co., Fort Worth, Tex., succeeded **Osborne Q. Nathan**, who has moved to one of the vice president of Bell Aerospace Co.'s Aerospace Division, Bellville, N.Y.

**Arnold F. Kuntz**, director of corporate planning, Cetus-Wright Corp., Wood Ridge, N.J.

**William J. Kido**, chief project manager, Hughes Laboratory, Link Division of General Precision, Inc., Burlington, N.Y.

**Michael A. Menden**, systems manager for the newly established Palo Alto (Calif.) facility of Fairchild Camera & Instrument Corp.'s Defense Products Division.

**National Aerospace and Space Administration** has established an office at Vertec Co.'s Space Systems Division, Baltimore, Md., to serve as an information and coordination center for the company and Vertec.

**Harold Vogel** has been named manager of the office.

**Dr. John D. Conley**, director of the newly established Optical Analysis Division of Photophysics Inc., Berkeley, Md.

**James E. Brooks**, manager systems design, Electronics Division, North American Aviation, Inc., Downey, Calif.

## Northrop Space Laboratories needs uncompromising men



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**Scientists**, to perform research in nuclear and radio chemistry, and to conceive and carry out investigations in the fields of activation analysis, dosimetry, gamma ray spectrometry, surface phenomena, and numerous other areas.

**Structural analysts**, to develop fresh analytical techniques and apply them to new space structural concepts, to do stress analysis and design optimization studies on advanced space vehicle structures.

**A plasma physicist**, to join our growing program in the measurement of plasma properties, spectroscopy, diagnostics, accelerators, and power conversion devices.

**An astrophysics physicist**, to concentrate on systems analysis and operations research applied to military and nonmilitary space systems.

**Physicists** experienced in electron optical imaging devices and laser theory, explaining, mathematics interested in detection theory, reconnaissance and tracking electronic engineers who know their way around statistical communications theory and noise phenomena, for one and/or other work in satellite detection systems.

For more information about these and other opportunities, write to M. E. Probst, Space Personnel Office, 181 East Broadway, Hawthorne, California. You will receive a prompt reply.

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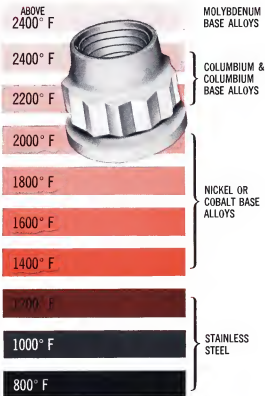
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Special close-clearance nuts to develop tensile strength of 160 KSI at temperatures to 900°F when used on bolts of same material. AMS-6304 chrome moly vanadium steel, silver plated. Sizes 10—32 through 3/8"—24.



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High performance nuts to develop full strength (260 KSI) of bolts of same material at temperatures —300°F to 1400°F. Used for reduced times and loads up to 1800°F. Rene 41, silver plated. Sizes 10—32 through 3/8"—24.



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Shank type nut for turbojet flange sections. Develops full tensile strength of Waspalloy bolts up to 1400°F. Waspalloy PW4586, silver plated. 1/4"—28 size, two shank lengths.



RG38-2644

Radial gang nut strip for flange assemblies, to develop full strength of bolts of 347FM or 303 stainless steel at 1200°F. Nut—AISI 347-FM, silver plated, size 5/16"—24. Channel—AISI 321 passivated.



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